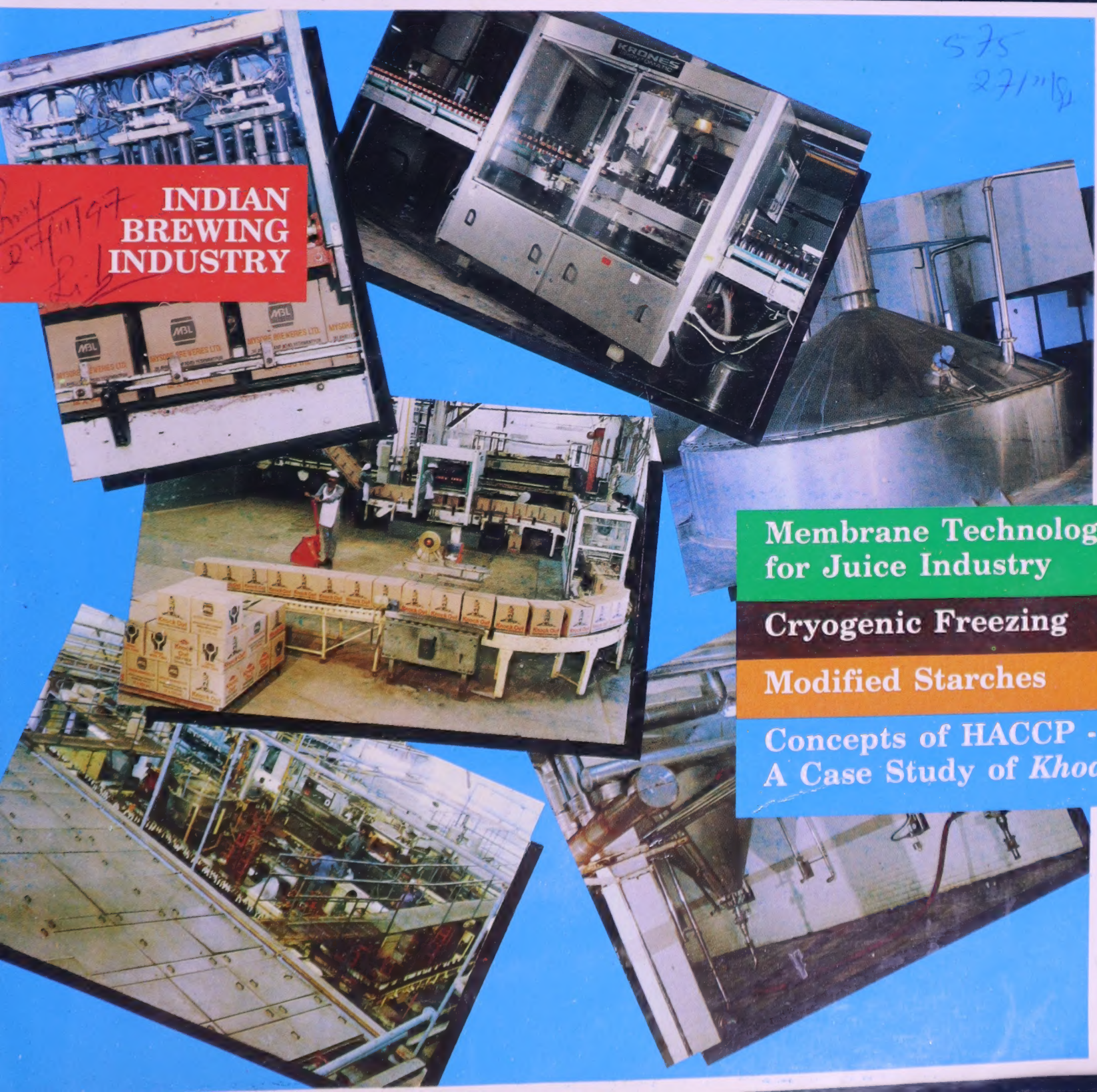


INDIAN FOOD INDUSTRY



VOLUME 16
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JULY/AUGUST

PUBLICATION OF ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (INDIA)



Membrane Technology
for Juice Industry

Cryogenic Freezing

Modified Starches

Concepts of HACCP -
A Case Study of *Khoa*

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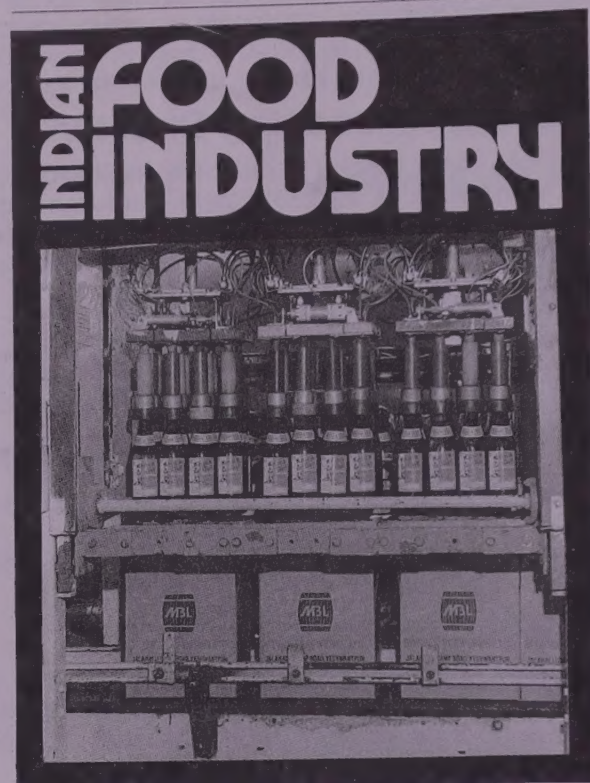
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Brewing Machinery

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Food industries may send information (suitably illustrated with photographs) about their new products, machinery, business ventures and other developments, which will be published on the discretion of the Editorial Board.

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JULY - AUGUST 1997



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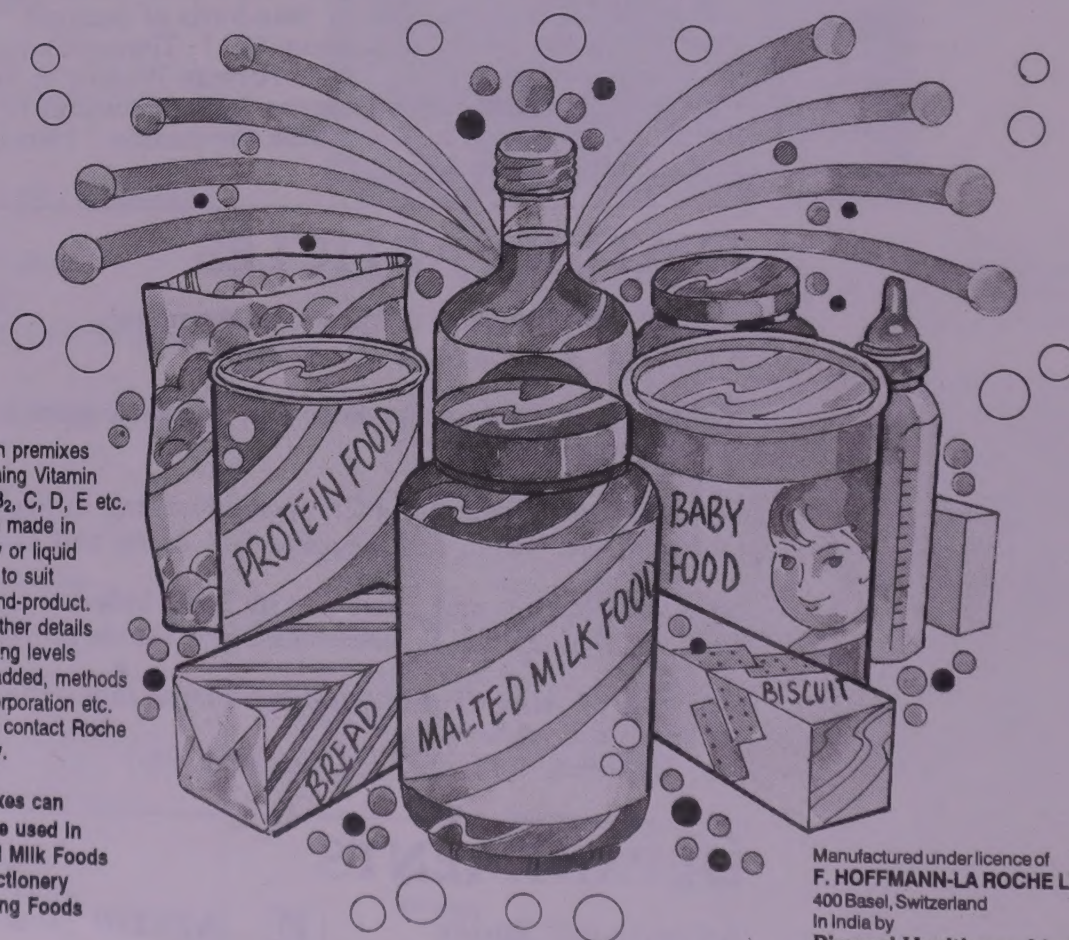
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FROM THE CHIEF EDITOR'S DESK

Any of the eastern cultural practices can be a mystifying burden on the mind, until it is demystified with scientific rationale or explanation. While the origins of these practices themselves remain a mystery, majority of us in this country in the colonial and post-colonial era, had slipped into scepticism of several things Indian, not necessarily for lack of scientific rationale. Yoga for instance, is being re-discovered by us, the very originators of yoga, only after the west saw in it a gold mine of physical and mental health. In demystifying yoga, an explanation offered for the benefits is that the adopted yogic postures cause perfusion with blood in circulation, of ductless glands in the body that produce hormones to facilitate enhanced and balanced hormonal output. Well regimened hormone therapies for specific deficiency disorders are known. The gross misuse of hormones for artificial athletic and sexual prowess is also common knowledge. Therefore, the biotechnological enterprise of the past two decades for hyper-expression of mammalian hormone genes in microbes and the unprecedented availability of hormones in quantity could turn out to be a double-edged sword, if stringent regulatory measures in hormone application are not enforced. Even the bovine growth hormone commercially produced by recombinant DNA a decade ago in the west was not totally welcome in the beginning, as small dairies protested that the 20% increase in milk production by growth hormone-treated cows would grossly distort the profits more to the large dairies. The decision to use bovine growth hormone for enhanced milk production in India must be welcomed wholeheartedly (Industry News p. 15, this issue). But the questions keep coming back. Why do we always follow suit rather than lead ? How long one should wait to see the day, when we will be in a position to lead? These are the questions for which we have to find the answers.

Richard Joseph
Chief Editor



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New Laws Soon to Regulate Use of Food Additives

The Food Processing Ministry is planning to change the norms of the use of additives in food processing. The Ministry is presently considering the proposal made by the industry associations for giving more powers to the Good Manufacturing Practices (GMP) adopted by the manufacturers for the use of additives.

These changes, if carried out, will be in addition to the recent amendments made in the FPO. According to the recent proposal, the industry has urged that the limit of additives used in the food processing should not be a part of the order, rather the good manufacturing practices adopted by the manufacturer should decide the limit of their usage in the products.

Moreover, it is urged that the specifications of the manufacturing facility should continue to be a part of the order, but at the same time the minute details and facilities required should be dealt with the good manufacturing practices, since the manufacturers are more aware of the necessities.

These requests have been made mainly after the ministry carried out some major amendments in the order for regulating hygiene conditions of manufacturing and specifications of the product.

Since the industry was not happy with certain provisions of the order, they made a repre-

sentation to the ministry. Following this, the FPO was liberalised in May this year.

The important amendment to the order is that the manufacture can get the licence renewed upto 10 years, while earlier the manufacture had to get it renewed it annually.

As per the new order, certain ministry approvals which were necessary are now ruled out. For instance, earlier an approval was necessary for changing the packaging or for making it more innovative, but now no such approval is needed required, provided the product confirms to the food grain quality.

Similarly, earlier ministry's approval was necessary for change or modification in the label, which is now ruled out.

Fruit Products (Amendment) Order 1997

In exercise of the powers conferred by section 3 of the Essential Commodities Act, 1955 (10 of 1955), the Central Government has made the following order further to amend the Fruit Products Order, 1955. namely :-

I. (1) This order may be called the Fruit Products (Amendment) Order, 1997.

(2) It shall come into force on the date of its publication in the Official Gazette.

What These Amendments Mean ?

Clause 2

The word "Synthetic" has been replaced by "non-fruit" for such preparations as, Non-fruit Beverages, Syrups and Sharbats which contain sugar, flavours and colour, but does not contain any fruit substance. It was urged by the industry that the word "synthetic" was sending wrong signals regarding fruit products.

Clause 3

While earlier the definition of "fruit products" used to include all unspecified items relevant to fruits and vegetables, this amendment now makes it binding that such unspecified fruits and vegetable products will have to be microbiologically safe and would contain only permitted additives within permissible limits, so as to be qualified to be reckoned as a fruit product.

Clause 4

This amendment will enable one representative of the consumer organisations to be a member of the Central Fruit Products Advisory Committee constituted by the Central Government to advise the Government on any matter pertaining to fruit preservation industry.

Clause 5

As against the earlier practice of annual renewal of licence, this amendment now, provides for block renewals for 3, 5 or 10, years thereby offering the entrepreneurs

an option to extend the tenure of licence beyond one year.

Clause 6

This amendment dispenses with the earlier practice of label approval which could result in procedural hassles and delays. Earlier, label of any packed fruit product was required to be approved by the FPO Licensing Officer. However, the present amendment specifies in detail the label for every packed fruit product in item 2, Part XX of the Schedule. Manufacturers abiding by such specifications on labels are not required any further to approach the Licensing Officer for approval.

Clause 7

This amendment makes the declaration on label and advertisements on Sweetened Aerated Waters, (which contains no fruit juice or fruit pulp), more brief and pointed by stating that the product "contains no fruit".

Clause 8(i)

This amendment confers the status of fruit syrup on such syrups and sharbats which contain a minimum of 10% dry fruits, which was hitherto not recognised.

Clause 8(ii)

This amendment provides for further innovation in pickles making. Earlier, FPO recognised only 3 types of pickles, such as pickles in oil, pickles in brine and pickles in citric acid/vinegar. This amendment has introduced an omnibus variety of pickles without media. This will provide relief to such manufacturers, who were feeling bound down by the specifications of oil or limitations of single media. Now, they can resort to a combination of media and other additives.

Clause 8(iii)

This amendment envisages aseptic and flexible packaging,

material having food grade quality, conforming to BIS specifications. This will help the processed fruit manufacturers to adopt modern packaging options.

Clause 8(iv)

This amendment has enlarged the list of food additives, by adding artificial sweeteners such as Aspartame and Aceflume K in the entire range of fruit products, as well as food acids (malic acid, citric acid, tartaric acid and lactic acid). While the permissible limit of artificial sweeteners has been fixed according to FDA, EEC and Codex standards, the food acids are required to be added as per Good manufacturing practices.

By expanding the ambit of food additives, this amendment enhances the possibilities of having more innovative product formulations and also extends the concept of good manufacturing practice in processed fruit sector.

Milk Production Reaches a New Height

India is poised to emerge as the largest milk producer in the world in the next couple of years, overtaking the US, which produces 70 million tonnes annually, according to Dr. M.L. Madan, Deputy Director-General (Animal sciences) of the Indian Council of Agricultural Research (ICAR).

He added that growing at the rate of 2-3 million tonnes annually, the country's milk production in 1996-97 touched 68 million tonnes.

The National Dairy Research Institute has setup a Computer-aided modern dairy plant (MDP) at a cost of Rs. 11 crores has an installed capacity of 60,000 litres per day. While the National Dairy

Development Board (NDDB) funded the entire project cost of Rs. 11 crores, it has shared the working capital investment of Rs. 1 crore equally with the ICAR.

The MDP which will be commercially run by the third year students of the B.Tech (Dairy Technology) course of the NDRI, was formally opened by the NDDB Chairman Dr. V. Kurien, and the Union Minister of Agriculture, Mr. Chaturanan Mishra.

The automated commercial-scale dairy plant is expected to be expanded to a capacity of one lakh litres per day in the second phase.

It can process and pack fluid milk up to 3,000 litres per day, cheese and paneer-1.5 tonnes per day, ice-cream of 500 litres per day and butter/ghee up to 500 kg per day.

The project, delayed for a couple of years, started functioning early this year. It receives chilled milk from the Karnal Kurukshetra Milk Union as well as the Milkfed of Punjab.

The milk and milk products made and packaged at the MDP are being sold in Haryana at the moment.

The project funded under Operation Flood by the NDDB has the twin objectives of providing infrastructure for in-house training to students for gaining experience in running a commercial dairy plant and to scientists of NDRI for upscaling their research and development concepts from the laboratory to industry scale.

India's First Ostrich Farm to Come Up in Karnataka

Ostrich India Limited is planning to set up an Ostrich farm at Periyapatna in Mysore district

Karnataka. This is likely to be the first ostrich breeding farm in the country.

The farm is likely to be operational by September this year. The ostrich farm would supply either birds or chicks to the farmers or entrepreneurs interested in ostrich farming.

The ostrich farm is being set up by five or six members of the recently formed, Forum on Technology for Ostriches, India (FOTO). FOTO is an umbrella group formed with the intention of bringing together farmers and entrepreneurs interested in ostrich farming. The organization currently has about 70 to 80 members, almost 90 per cent of whom are from Karnataka. Enquiries from large farmers and entrepreneurs residing in other States, are also pouring in.

A team consisting of FOTO members is currently in Australia to work out a tie-up with the Ostrich Association of Australia. An ostrich farm is usually spread over about five to six hectares and has about 50 to 60 birds.

Ostrich farming is catching in Europe, United States and even Israel. The meat had immense potential for exports, as it fetches about 35 dollar per kilogram in Europe and the United States. The demand and interest in ostrich meat has been increasing especially after the threat of Mad cow disease.

Export market is being targeted as the meat is too expensive for the domestic consumers.

Poultry and Dairy Exports Double in 1996-97

India's export of poultry and dairy products doubled in value

terms during 1996-97 compared with 1995-96.

Exports of poultry and dairy products shot up to Rs 118.80 crores during 1996-97 against shipments worth Rs 58.76 crores during 1995-96.

United Arab Emirates was the largest importer of Indian poultry and dairy products. It imported products worth Rs 23.80 crores, a steep increase from imports worth Rs 14.35 crores during 1995-96.

The fiscal year also saw a phenomenal rise in exports of these products to Germany.

From a meager Rs 2.22 crores exports of poultry and dairy products in 1995-96, shipments totalled Rs 20.76 crores in the last fiscal year, almost a ten fold increase.

The other significant importer of Indian poultry and dairy products was Oman. Exports to that Gulf nation nearly trebled to 13.59 crores from Rs 4.24 crores.

Belgium also bought a considerable amount of poultry and dairy products. It imports increased to Rs 8.34 crores in 1996-97 from a meagre Rs 1.51 crores during 1995-96.

The poultry industry in the country is all set to register a three-fold increase in exports, from around Rs 100 crores last year to Rs 300 crores this year.

The chief executive of the National Egg Co-ordination Committee (NECC), Mr K Satyanarayana, said eggs from the European countries have become costlier following partial scrapping of subsidies to poultry farmers by some of those countries, which is forcing the large middle-eastern economies to look to the Indian poultry industry as an alternative source of supply.

Mr Satyanarayana said that the industry is trying to step up its exports to the far-eastern markets like Hong Kong, Korea, Singapore,

and Thailand, as also to Germany and Belgium.

Indian exports comprise shell eggs, egg powder and processed poultry meat. Amongst the three items, egg powder enjoys good demand in the overseas markets and accounts for a major share of the poultry exports. Egg powder is exported in various forms such as white egg powder, mixed egg powder, and frozen liquid egg powder. The share of egg powder in last year's exports was to the tune of Rs 70 crores (of the total Rs 100 crores worth exports) and the same is expected to shoot up to Rs 200 crores this year (out of the total Rs 300 crores).

Miracle Foods to Export Tender Coconut Water Concentrate

Kerala's Miracle Foods is all set to enter the export market with a new ready-to-serve tender coconut water concentrate developed for the first time in the country using German technology.

The Miracle Food Processors International Ltd, which has set up its plant at Perinthalmanna at Malappuram, has already launched their product under the brand name 'Zat' in the state. The company has been set up in technical collaboration with Winter Umwel of Germany.

Miracle Foods was set up in 1994 with a total investment of Rs 3.4 crores.

The Rs 16 crore group, with interest in rubber-based industries, first came out with pineapple concentrates and later used the same technology for producing tender coconut water concentrates.

The company spokesman told that the product had no artifi-

cial ingredients. and all the natural ingredients were retained in its original form.

Tea Production in South Increases

While the South Indian tea production for the first half of 1997 has touched 95 million kgs as against 85 million kgs produced during the previous corresponding period, it is feared that production in North India may receive a set back.

According to information, the southern tea plantations have succeeded in improving production mainly on account of favourable climatic conditions. However, the same may not be true in the case of northern plantations as flood and drought in different zones have affected the production schedule.

Though northern production during January-May 1997 has been estimated at 113.60 million kgs as against 110.50 million kgs during the previous corresponding period (up by 3.10 million kgs for the period), it was felt that May 1997 production could possibly throw light on the emerging trend.

The northern tea output during May 1997 has been estimated at 37 million kgs as against 43.10 million kgs registered in May 1996, a negative growth of 14.15 per cent.

This trend is expected to continue for the next two or three months and the current year production could fall behind 1996 output in a big way.

The pessimism stems from the fact that a negative growth rate of 16.17 per cent and 8.87 per cent have been witnessed during May 1997 in Assam and West Bengal, the two major tea growing States in the country.

Despite southern tea production making impressive gains, it may still not be possible to alter the overall production scenario in a big way, as north India production is very crucial.

Sugar Production Falls in Tamil Nadu and Karnataka

While there was an increase in tea production in the South as reported in the preceding column, Tamil Nadu and Karnataka have recorded a steep fall in sugar production for the 1996-97 sugar crushing season. While Tamil Nadu has reported a 32.25 per cent decline, Karnataka witnessed a 27.78 per cent fall in production.

During the 1996-97 crushing season (up to July 31, 1997), Tamil Nadu mills (including two mills in Pondicherry) have crushed 116.57 lakh tonnes of sugarcane and produced 10.42 lakh tonnes of sugar, as against 180.98 lakh tonnes of sugarcane crushed for a production of 15.39 lakh tonnes of sugar in 1995-96 sugar season.

Likewise, mills in Karnataka have crushed 79.27 lakh tonnes of sugarcane and produced 8.54 lakh tonnes of sugar during the 1996-97 season (upto June 30, 1997). For the 1995-96 season, the mills had crushed 121.26 lakh tonnes of sugarcane and clocked a production of 11.82 lakh tonnes of sugar.

The average recovery during the 1996-97 season improved to 8.94 per cent from 8.50 per cent in the case of Tamil Nadu mills, while Karnataka mills registered an average recovery of 10.77 per cent as against 9.75 per cent recorded during the 1995-96 season.

It is interesting to note that none of the sugar mills in Tamil

Nadu crossed the recovery rate of 10 per cent during the 1996-97 season.

On the contrary, many sugar mills in Karnataka have recorded a recovery rate of over 10 per cent. Further, five mills have achieved recovery of over 11 per cent, while one of the mills in the co-operative sector registered a recovery of 12.01 per cent. A private sector sugar mill has recorded a recovery of 7.94 per cent, which is the lowest in Karnataka.

While most of the sugar mills have stopped crushing activities for 1996-97 sugar season (October 1996 - September 1997), it is understood that two factories in Karnataka have started working from July and have crushed between them 14,937 tonnes of sugarcane and produced 558 tonnes of sugar.

Domestic Methanol Prices Likely to Fall

The surge in the domestic price of methanol over the last three months is not expected to sustain for long and the price is expected to fall in the near future. This is because of the reversal of trend in the international markets.

International spot prices, which were around \$ 200 per tonne in January 1997 had gained appreciably to \$ 270 in April 1997, before falling back to the ruling level of \$ 230. Reflecting this trend, domestic methanol prices after staying stagnant at Rs 9,960 per tonne throughout 1996-97 has moved up to around Rs. 11,550 per tonne during the first quarter of 1997-98.

A major factor that has contributed to the buoyant domestic prices is the temporary shortage in domestic methanol supply arising

out of the shut-down undertaken at the methanol plant of Deepak Fertilizers Ltd. This plant is one of the largest methanol unit in the country with a capacity to manufacture 1,00,000 tonnes per annum. Company sources opine that there was a break-down at the plant and it also had to undertake a catalyst change, which necessitated the shut-down.

The unit is now back on stream, restoring the domestic supply position. However, cheaper imports over the last one month as a result of lower international prices seems to be posing a threat to the profitability of domestic methanol producers, who have so far had a good year. Industry sources opine that the current landed cost of methanol imports is around Rs 10,500 per tonne, cheaper than the domestic price by Rs 1,000 a tonne. This they feel, should probably force domestic producers to cut prices in the near future.

The outlook for international methanol prices for the near future is not very bullish, as the threat of surplus capacity looms large in the international methanol markets, say traders.

The world methanol capacity is around 30.7 million tpa, which means a surplus of over 5 million tonnes for 1996-97.

With demand expected to grow by only around five per cent annually, the surplus situation is expected to stay for some more years and consequently maintain pressure on prices.

Crash in Oilmeal Prices May Hit Indian Exports

Crash in international oilmeal prices with an expected 10 per cent increase in soybean

acreage in the US is likely to have an adverse effect on the Indian oil-meal exports. The depressed prices are not yielding good returns according to exporters.

Soybean planting in the US are estimated at 70.9 million acres up 10 per cent from 1996 plantings and 13 per cent above 1995. According to exporters, this is the largest planted area of soybeans in the US since 1982. This has resulted in a decline in global oil-meal prices. The soymeal, which was quoted at \$330 FoB in March, 1997, has now gone down to \$265 and is expected to ease further in the coming months, said Mr B V Mehta, Executive Director of Solvent Extractor's Association of India (SEA). In 1996-97 the total earning from oilmeals was Rs 3195 crore against Rs 2382.2 crore earned in 1995-96. However, if the present price trend continues the export earnings may not touch the estimated figure of Rs 3116 cores for the current year.

SEA has made a representation to the union ministry of commerce suggesting measures for sustaining the export of oilmeals. The Association claims that in the absence of institutional arrangements like registration of contract, they feel handicapped for evolving a market strategy to maintain India's share in the international market.

Exporters claim that the demand for oilmeal as animal feed has been on the rise. The choice has shifted from animal proteins to vegetable proteins after the mad cow disease occurred in Europe. China's demands appear to be up by 3.2 million tonnes to a record 23.5 million tonnes. It may be recalled that soybean prices had registered an upswing from the autumn of 1995 until early 1997.

Thailand Approves Import of Soybeans

Thai feedmills scrambled to buy after the government finally approved imports of 150,000 tonnes of tariff-free corn.

One major oil crusher was said to have just bought 30,000 tonnes of Argentine soybean for August shipment. Price details were not known.

Traders said that some feedmills who anticipated the government's go-ahead to the corn imports had started buying.

The Thai cabinet gave a green light to the industry to import 150,000 tonnes of zero tariff corn to alleviate a shortage caused by a dry spell.

The corn must be imported by August 31 as local supplies were expected to be available by then.

The government projected the shortage during July and August at around 175,950-198,550 tonnes.

The government earlier approved 200,000 tonnes of corn imports under a similar scheme.

The soymeal market was quiet with only modest buying, as the industry was sidelined by rising prices.

70 Per cent of Edible Oils in Maharashtra Adulterated

Maharashtra produces and markets edible oils worth Rs 30,000 crores annually and 70 per cent of this commodity is adulterated. Further, groundnut oil being the

most expensive among the edible oils, is invariably adulterated by mixing either palm oil or rapeseed oil, which are considerably cheaper.

This was revealed by Mr Anilkumar Lakhina, Commissioner for Food and Drugs Administration (FDA), while addressing a meeting at the Indian Merchants' Chamber in Mumbai.

"Of the edible oils marketed in Maharashtra, only 10 per cent are sold in packed form and the remaining 90 per cent are sold loose," he added.

"If we file cases against 100 offenders, generally not more than one gets punished, that too after inordinate delay," Mr Lakhina pointed out. No wonder, FDA has been reduced to doing no more effective in this frustrating legal environment, we have now begun more drastic actions, including forced closure of the outfits of culprits, so that the public will begin to take notice," he added.

Besides edible oils, other major foods adulterated on a large scale in Maharashtra are milk and spices.

"Of all the milk sold daily in Mumbai, 60 per cent is in packaged form and the rest in loose form. "It is no great secret that the fat content of milk can be raised to high levels by adulterating with cheap animal fats," he said.

He regretted that consumers hardly ever bother to test milk promptly and help book the culprits.

Regular inspections of stocks in drug stores by FDA inspectors have shown that 'every ninth capsule or pill or other drug you buy from pharmacies is sub-standard. Of the 4,500 manufacturers in Maharashtra, only 66 companies produce as much as 70 per cent of the drugs.

He, however, blamed partly his own department's inadequacies for the problem. Of the department's food and drugs

divisions, inspectors belonging to the food division have no scope to rise beyond the supervisor's grade, while inspectors of the drugs division can rise to become even commissioners. "No wonder, licences for setting up restaurants and other catering establishments are there for the asking," he said.

There are also many shady areas where there are no effective laws. There are no laws to regulate veterinary drugs in the country. These are the areas in which some multinational and big houses are thriving.

Exports of Wheat Products May be Permitted

The Union Government is considering opening up exports of value-added wheat products. The Agricultural Produce Export Development Authority (APEDA) has recommended to the Union ministry of commerce that exports of value-added wheat products be opened up on quantitative ceiling basis, industry.

Meanwhile, officials reveal that the proposal for opening up exports of wheat products has been sent to the Cabinet for its consideration.

High-level talks are in progress on the possibility of Pakistan importing wheat from India. Pakistan has been importing wheat from Australia and USA.

Reports are that Pakistan is facing a severe shortage of wheat this year.

The domestic market for wheat products had been facing sluggish demand.

While wheat in the open market is quoting at Rs 620 per quintal, *maida* is quoted at Rs 650-

660 per bag (90 kg each) and *rava* is quoting at Rs 700 per bag.

Demand for wheat products is expected to improve from mid-August as the festival season would approach.

Cheaper coarse grains in interiors of the country have encouraged consumers switching from wheat and wheat products.

In the meantime, roller flour millers in the country have sought the resumption of wheat products exports, which has remained suspended since March 31, 1997, in the absence of release of further quota.

The flour millers opine that now, when the country has procured one million tonnes more wheat than the last year, the government should open up exports of wheat products.

Further, to augment supplies, the government has gone for the import of wheat. Domestic supplies, coupled with large imports has certainly helped in augmenting supplies of wheat.

The Food Corporation of India (FCI) has procured 9.25 million tonnes of wheat till the end of June 1997, against 8.18 million tonnes procured last year.

Tiger Oats to Help ITC Agrotech with Expertise

The \$3.8 billion food major of South Africa, Tiger Oats Limited, will also provide its expertise to ITC Agrotech Ltd along with the US-based food giant, Conagra Inc, which is acquiring the controlling stake in the ITC group company.

Tiger Oats is a minority partner of Conagra in its Mauritius-based subsidiary company, CAG-Tech (Mauritius)

Limited, through which the American company is acquiring a 51.4 per cent stake in ITC Agrotech. The \$24-billion Conagra earlier proposed to acquire a 34 per cent stake in AGrotech, which was also approved by the Foreign Investment Promotion Board (FIPB).

However, the company has now decided to increase its proposed share holding to 51.4 per cent through its Mauritius-based subsidiary, CAG-Tech Limited.

According to the latest application submitted by the company of FIPB, the association of Tiger Oats would benefit ITC Agrotech considerably.

The company occupies a leading position in the food industry in South Africa and has a well-balanced portfolio of activities across the operations of food manufacturing, processing and distribution including branded staple food.

The application stated that "Tiger Oats would bring in its relevant experiences and skills to the emerging food market in India and the arrangement between Conagra and Tiger Oats would strengthen the competitive position of ITC Agrotech."

ITC Agrotech is currently engaged in the business of crushing of minor oilseeds, solvent extraction of oilcakes, refining of edible oils and import and distribution of edible oils.

However, after equity participation of Conagra, the activities of the company will be expanded to include investment and operations in grain-based products, pulses, spices, other food-related products and the import and export of agri-products apart from strengthening the existing edible oil business.

Seafood Exports Hit Trick to Cross \$ 1 Billion

Seafood exports have crossed the \$1 billion mark for the third time in succession. According to official sources, the share of marine products in total export earnings was 4.3 per cent during 1996-97. Exports have registered an impressive growth by 27.65 per cent by value. Though the growth was considerable, the unit value realization has declined to Rs. 108.97 from Rs. 118.17. The decline in unit value could be attributed to the larger quantum of low valued fin fish export which has pulled down the unit value.

Frozen shrimp continued to be the major item, contributing 65.56 per cent of the value, followed by frozen fish (15.36 per cent), frozen squid (7.05 per cent), frozen cuttlefish (6.61 per cent), other items including live/fresh chilled/dried/minor items together constituted 5.42 per cent. In terms of volume, fin fish is the major item sharing 45.64 per cent followed by frozen fin fish (27.88 per cent), frozen squid (10.82 per cent), frozen cuttlefish (18.40 per cent) and others such as live/fresh chilled/dried and minor items were to the tune of 7.26 per cent.

The share of items such as cephalopods (squid, cuttlefish and octopus), chilled items and lobsters has declined while that of frozen fish, frozen shrimp, dried and live items increased their share considerably, which resulted in the export growth.

Japan continued to be the single largest market for marine products lifting 64,656 tonnes (11.1 per cent) valued at Rs. 1,886,04 crores (45.76 per cent) followed by Southeast Asia sharing 52.19 per cent in terms of volume and 21.33 per cent in terms of value. Mem-

ber countries in EU had lifted 71,236 (18.84 per cent) tonnes of seafood items valued at Rs. 790,69 crores (19.19 per cent) followed by the U.S. 29,792 tonnes (7.88 per cent) valued at Rs. 436.05 crores (20.58 per cent) during the period, while West Asia shared 2.61 per cent (9,879 tonnes) by volume and 1.57 per cent (Rs. 64,75 crores) by value.

Exports to Japan have increased by 24.84 per cent (12,867 tonnes) in terms of volume and the value by 19.62 per cent (Rs. 309.35 crores). India, despite natural calamities and other problems in the East Coast, could increase its shrimp exports to Japan by over 18 per cent as compared to the same period in the previous year. Due to high prices, Thai shrimp lost its market share in Japan and India could cash in on the situation and has emerged as the second largest supplier of shrimp to the Japanese market after Indonesia. All major markets except European Union have shown a positive growth during the period.

Though there were problems for export to the U.S. due to shrimp embargo related to turtle extruder device issue, exports to that country have actually increased by 14.55 per cent in terms of volume and 19.05 per cent in terms of value as compared to the previous year. It may be noted that import of shrimp into the U.S. market during 1995 has declined due to overall supplies from Asian countries.

China emerged as the single largest market for marine products last year lifting 25.22 per cent of the products in terms of volume. However, in terms of value, it is the third largest market after Japan and the U.S. Countries like Japan, the U.S. China, Hong Kong, the U.K., Spain, Italy, Singapore, Belgium and Malaysia shared over 87 per cent of India's exports in terms of value.

MPEDA and KINFRA Improve Quality Standards of Seafood

In a long term plan to improve the quality standards in the seafood industry, the Marine Products Export development Authority (MPEDA) and the Kerala Industrial Infrastructure Development Authority (KINFRA) would jointly invest Rs 200 crores to provide infrastructure facilities to the industry like continuous power supply, clean water, peeling sheds etc.

Senior officials of the MPEDA said that India would stand to lose the US market if the seafood industry were not complying with the HACCP regulation, announced by the USFDA, before December 17, 1997.

If there is any slippage on this front, India will lose the Rs 400-crore US market, which accounts for 10 per cent of the total seafood export value and seven per cent of the quantity exported.

Meanwhile, in the short run, the MPEDA would launch an action plan to upgrade the quality standards in at least 50 units to enable them to meet the quality standards prescribed by the European Union (EU). It may be recalled that after imposing a ban on seafood imports from India after August 4, the EU had extended the deadline for accepting the products exported from India till mid September 15. The EU will review the ban by the end of November.

Mr K.B. Pillai, chairman, MPEDA disclosed that an EU team will be visiting India before the review.

Taking into account the industry's complaints about recurring power cuts and weather shortage, the MPEDA has decided to tie up with the Kinfra to float a new company.

The company will set up a 50 MW naphtha-based power plant for which MPEDA has already applied to the government for further naphtha allocation. The company will also implement a water supply scheme to provide clean water to the processing and export units.

Effluent treatment systems, ice plants and common peeling sheds are also being planned under the scheme.

Meanwhile, the disease problem has once again surfaced in certain pockets like Gopalpur in Orissa and in some traditional farms in West Bengal. The disease has resulted in a 20 per cent fall in the production of shrimp.

The allround problems faced by the industry is likely to bring the total seafood exports down to the 1995-96 level of Rs 3,500 crores compared to Rs 4,100 crores in 1996-97, a fall of Rs 600 crores.

The year 1997-98 had started well with a 10 per cent increase in quantity of exports and a 20 per cent increase in the value in the first four months compared to the same period last year. But these achievements would be lost because of the problems plaguing the industry.

Ecologists Protest Against New Aquaculture Bill

Environmentalists have strongly protested to Prime Minister I.K. Gujral and Environment Minister Saifuddin Soz that the opposed legislation on aquaculture

would be environmentally and constitutionally destructive.

The Aquaculture Authority Bill, 1997, which has already been passed by the Rajya Sabha, would be moved in the Lok Sabha in the coming monsoon session.

In a letter to Mr Soz, the environmentalists have also protested against the manner in which the bill was introduced and passed in the Rajya Sabha in March this year. It violates constitutional propriety, they allege.

"How the agriculture ministry has been allowed to carry out such an amendment when this is the sole prerogative of the environment ministry"? they ask.

"A bill which seeks to deal with the protection of the coastal environment can, under the rules of the business, only be introduced in Parliament by the environment ministry alone," the letter says.

Thermax's Joint Venture with US Company

The Pune-based Thermax Ltd has entered into a joint venture agreement with Culligan Water Technologies Inc-USA to manufacture water purification products for both domestic and commercial use. The new company named Thermax Culligan Water Technologies (P) Ltd will manufacture and distribute household products and services as well as produce, distribute and sell 5-gallon bottled water in India. The joint venture will set up a manufacturing facility in Pune and state-of-the art 5-gallon bottled water factory in Mumbai.

American Brown-Forman Whisky to Substitute Scotch

Jagatjit Brown-Forman, India is launching a domestically bottled imported bourbon whisky, Forester 1870 in India. A director at the Brown-Forman Beverages worldwide was in India recently to promote American bourbon whisky as a substitute for scotch. He has been promoting the bourbon drinking habit in a country, where it has barely any presence. Imported whisky bottlers have been facing an uphill task with less than 10 per cent market share in the 8-lakh case Indian scotch whisky market. About 1.5 lakh cases come with tourists, 2.3 lakh cases are counterfeit scotch and 2 lakh cases are smuggled.

Beware ! Creamy Non-vegetarian Milk Around !!

Beware! The milk you consume may be non-vegetarian. Fast-buck milkmen in Lucknow are using unhygienic animal fat in milk to make it look creamy and have forced many a vegetarian into non-vegetarian.

What is astonishing is the fact that the animal fat may be an old extract.

The animal can vary from buffalo to goat and some use pig fat also. There is more to milk than meets the eye - detergents, urea, starch and soda ash are some other ingredients.

The shrewd milkmen add sugar to confuse even the ever vigilant consumers, who keep lac-

tometers at home. While urea, detergents, soda ash, starch, sugar, skimmed milk powder etc are mixed to maintain the gravity of the solid contents of milk continues, animal body fat are added to maintain the fat content of the milk. There are a microscopic minority of the honest thieves, who put vegetable oil to maintain the solid contents.

An average Indian buffalo milk contains around 8.9 per cent solids (called solid-not-fat in scientific terminology), 6 to 8 per cent fat and rest is natural water.

The *modus operandi* of these unscrupulous milkmen is to extract the fat (used in making of cream) content by using an apparatus called separator, which is easily available in the market.

The above mentioned contents are added to maintain the solid contents and gravity of the milk. Detergents like soda ash, sodium bicarbonate and urea were the most commonly used adulterants. Regular consumption could lead to their formation in the intestines, which is highly injurious to liver and kidneys.

A specialist said that there were simple tests to check whether the milk contained detergent. If turmeric was added to soda adulterated milk, it would turn red. As turmeric turned cloths, which had not been rinsed properly and had detergent in them into red, the same process was applicable in milk also.

There is a urease enzyme test to find out the content of urea and PAMB test to check soda content in milk but the most difficult test is to ascertain the content of animal body fat. Recently a chemical has been developed which with the help of crystallization process helps chemists in finding the species of animal, whose fat was adulterated in milk.

The spate of such incidents has necessitated holding of awareness camps, which are being or-

ganized all over the city by the Lucknow Producers Co-operative Milk Union Limited makers of the famous Parag brand of milk.

Realizing the present problems of adulteration in milk the free milk testing campaign at Arohi complex is first of its kind in Lucknow and first of the series.

Hormone Injections Approved to Boost Milk Production

Indian government has cleared commercial sale of synthetic bovine growth hormone (BGH) that boosts milk yield by 10 to 20 per cent and can potentially turn India into a milk surplus country. Monsanto, the US chemicals company, has been granted permission to sell its product in five States. Andhra Pradesh, Karnataka, Maharashtra, Haryana and Punjab. Developed through a process of genetic engineering about a decade ago, the hormone has already been in use in Europe and North America for several years.

While permitting its sale in India, the genetic engineering approval committee (GEAC) in the Ministry of Environment and Forests has, however, restricted the use of the hormone only in buffaloes for a period of one year to begin with. It will be sold only on prescriptions from veterinarians. Meanwhile, the US company has been asked to continue its field trials in 2500 crossbred cows to collect more data before its use is allowed in cows.

At least three multinational companies had been having an eye on the BGH market in India, worth Rs. 2,000 crores a year, but so far only Monsanto's product has been

cleared. The GEAC has turned down a request from Alembic Chemical Works Limited of Baroda for field trial of a similar product developed by LG group of companies of South Korea on the ground that the product had not been tested in any country other than Korea. The GEAC has also refused permission to Ranbaxy Limited of New Delhi for the import and marketing of BGH developed by Eli Lilly of the United States. The committee has forwarded the proposal to the Department of Biotechnology (DBT) for its advice.

The government's approval of the Monsanto product came after a 12 month field trial at the National Dairy Research Institute (NDRI) in Karnal. The trial showed that a dose of 500 milligram hormone injection twice a month increased daily milk production by 2.6 kg in crossbred cows and 2.5 kg in buffaloes. According to company sources, the injections would cost about Rs. 200 a month.

Dairy experts, however, described GAC's decision to allow use of the hormone only in buffaloes and not in cows as illogical. They are also surprised at the committee's decision to allow hormone injections only after the second lactation. They say that these unnecessary restrictions would block the introduction of useful biotechnology products into the country and delay the white revolution. It is pointed out that the NDRI trial had confirmed that the hormone was safe for both buffaloes and crossbred cows.

While mastitis (a painful inflammation of the udder) occurred in some of the cows, NDRI scientists have said that it was not related to administration of the hormone. BGH is a naturally occurring bovine hormone that increases lactation. It is commercially produced by splicing the BGH gene into bacteria, which is grown in large quantities in fermentation tanks. BGH was agri-bio-technology's first billion dollar product and the most extensively studied animal drug. More than 200 studies carried out so far had established that milk and meat from treated cows are harmless to consuming public.

Hamburger Poisoning in the United States

Some 25 million pounds of beef were recalled by the Hudson Food Company, as it indefinitely closed down its plant in Columbus, Nebraska - following evidence found by Government inspectors that an *E.Coli* scare was far more widespread than had been presumed. Inspectors from the Department of Agriculture had found weak safety standards and "risky" practices in the burger processing plant.

As required by law in America, the closure was a voluntary one on the company's part, but only after the Government had made it clear that unless it went

ahead, they would withdraw inspectors and thus render the plant illegal and forced to cease production.

The scare has been building up slowly, following the deaths of 16 sufferers from the bacteria in Colorado last month. The guilty burger at the cradle of the outbreak turned out to have been made by Hudson, whose headquarters are in Arkansas.

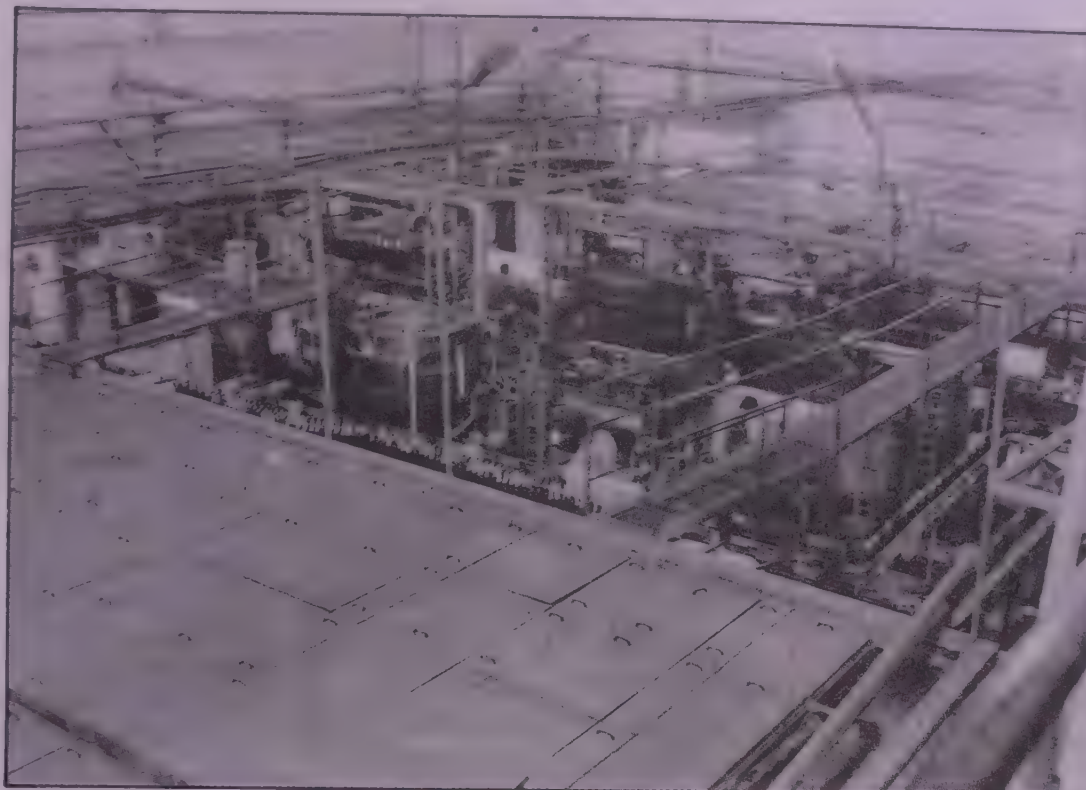
The investigators found that it was common practice at Hudson to refrigerate meat at the end of the day that had not been processed, and to mix it in, chilled but not fresh, with the next day's meat - a system frowned upon by health inspectors.

Inspectors did discover that due to a machine breakdown on a particular day thousands of pounds of meat were put back into refrigeration and - instead of being destroyed was mixed in with meat processed on the next day which, in turn, was mixed in on the following day and so on, setting off a chain of potential contamination.

Inspectors said that they could find no break in the chain and called for a recall right up to the present.

The panic and the possibility of an ensuing epidemic will throw light on the quirk in American law, whereby the Department is not allowed to directly force the closure of a meat plant or even to recall meat unilaterally or to collect civil penalty fines. This is despite the ever-growing evidence that meat production companies are cutting corners to increase productivity and profitability.

FEATURE ARTICLES



THE BREWING INDUSTRY IN INDIA - AN APPRAISAL

MEMBRANE TECHNOLOGY FOR FRUIT AND VEGETABLE JUICE INDUSTRY

PROBLEMS AND PROSPECTS OF CRYOGENIC FREEZING IN FOOD INDUSTRY

MODIFIED STARCHES AND THEIR USE BY FOOD INDUSTRY

CONCEPTS OF HACCP AND TRADITIONAL FOOD INDUSTRY - A CASE STUDY OF KHOA

The Brewing Industry in India - An Appraisal

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The brewing industry is spread worldwide. In India, the brewing industry dates back to the early nineteenth century and the beer then manufactured was supplied mostly to the British, stationed in India. The oldest brewery, the Castle Brewery was established in 1857. Beer is basically a mild alcoholic fermented beverage with considerable nutritional value and is becoming increasingly popular in India. An estimate of per capita beer consumption is almost meaningless given that a vast proportion of the population, for religious or economic reasons, will never be in a position to drink beer. An estimate of at least 100 million "middle class" potential beer drinkers shows that average consumption works out at only about three litres per annum. Beer is gradually replacing the high alcohol containing beverages in social drinking habits and the present growth of the production of beer in India is a clear indication of its acceptability throughout the country.

The recent history of brewing in India features the granting of licenses in 1970, when a large number of breweries were commissioned. These breweries reflect the technology of that time much of which was sourced in Eastern Europe, is still in operation today. A further trench of licenses was released in 1989-90, the utilization of which has led to the recent

upturn in brewery construction. A significant development for al-

Beer is basically a mild alcoholic fermented beverage with considerable nutritional value and is becoming increasingly popular in India.

coholic beverages industry is the approval for foreign investment,

There are currently at least 45 operational breweries in India with appropriate total capacity of 5 million hecto litres per year.

which has attracted industry leaders worldwide.

There are currently at least 45 operational breweries in India with appropriate total capacity of 5 million hecto litres per year (Fig.1). Nearly about 50% beer in India is sold in the south, while the share of west is about 30%. North India takes about 15% share in beer sales, whereas the sale amounts to only 5% in eastern India (Table 1). Traditionally, the raw materials for brewing are water, malt, hops and yeast along with adjuncts like rice and maize and processing aids like enzymes, acids, fining agents etc.

Barley Malt

Depending on the chemical constitution of the grain, barley is put to various industrial uses. Nearly 15% of the production is used for various industrial purposes. The malting and brewing industry has been further promoted under the liberalized economic policy of the Government of India. Nearly 85% of total barley produced is used as feed or as cereal (Table 2). The availability of wheat and rice through public distribution system has reduced the dependency of rural population on barley as a food cereal. At present, 6-row barley is used by the industry in India. There is a need for an organized effort to popularize the 2-row barley, which is more suitable for brewing industry.

The comparative analytical

The Brewing Industry in India - An Appraisal

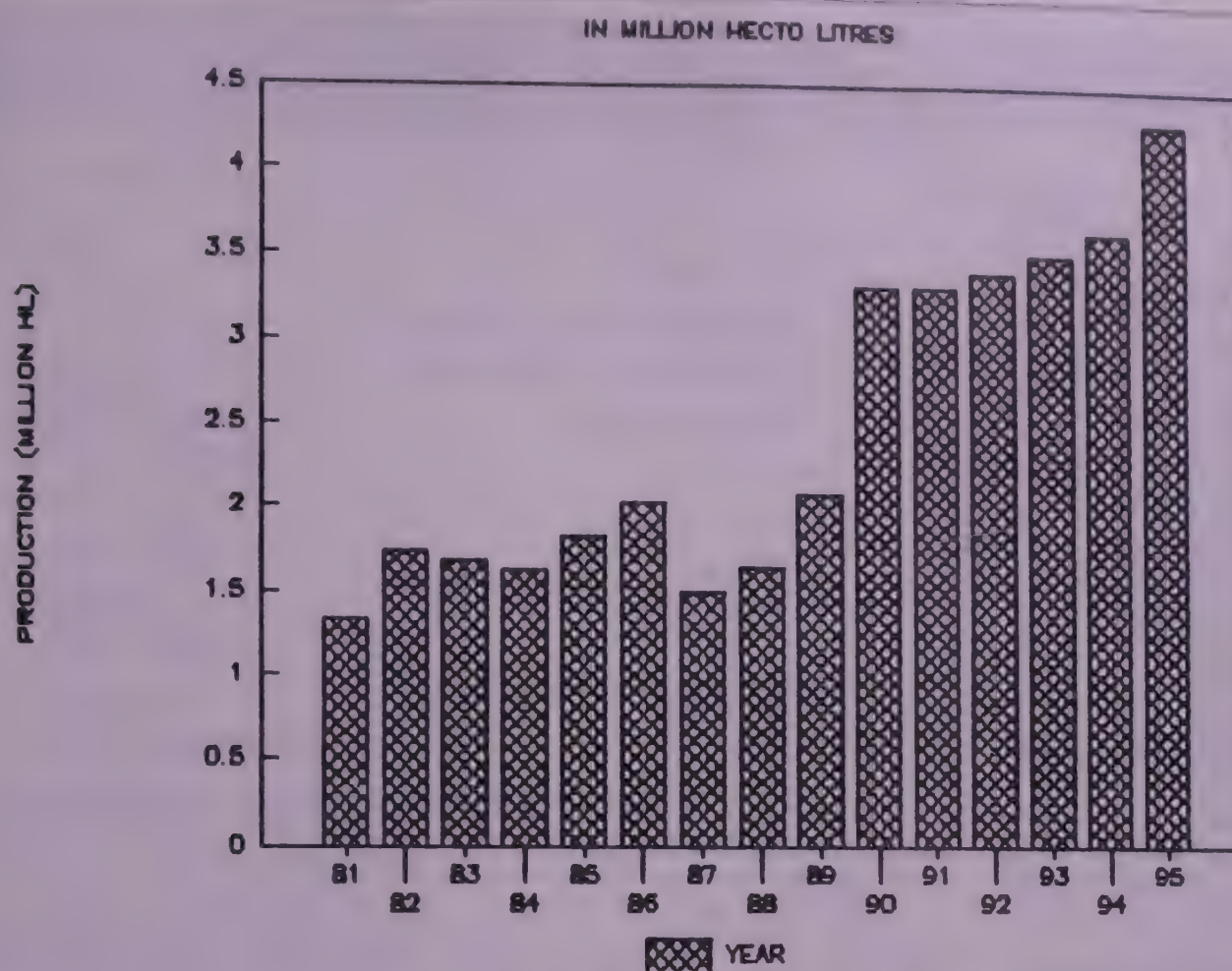


Fig 1. Production of Beer in India

Table 1 : State-wise Beer Sales in Dozen Bottles (includes CSD sales)

West		South	
Maharashtra	1,40,00,000	AP	70,00,000
Gujarat	1,50,000	Tamil Nadu	65,00,000
Goa	3,00,000	Karnataka	50,00,000
Daman	3,00,000	Kerala	36,00,000
		Pondicherry	4,00,000
Total	1,47,50,000		2,25,00,000
North		East	
Rajasthan	25,00,000	West Bengal	15,00,000
Delhi	12,00,000	Orissa	7,00,000
Uttar Pradesh	20,00,000	Bihar	8,00,000
		Chandigarh	2,00,000
		Haryana	11,00,000
		Punjab	13,00,000
Total	57,00,000		56,00,00

Table 2. Analytical Guidelines for Barley Breeders in India

Parameters	2-row	6-row
Barley grain		12.0
Moisture (%)		
Kernel shape	Elliptical with major axis of 2 to 2.5 times to minor axis.	
Kernel size	Uniform plump	Uniform plump
On 2.4 mm	90%	80%
Through 2.2 mm	3%	# 3%
Skinned/broken grains	10%	10%
1000 grain weight (g)	45 and above	42 and above
Husk content	11.0%	11.0%
Protein content (d.b)	9.0-11.5%	9.0-12.0%
Germination capacity	96%	96%
Dormancy	Some amount of dormancy to avoid the pregermination is essential.	
Malt factors		
Malt modification	Satisfactory modification with four days germination cycle.	
Malt homogeneity	90%	90%
(on malt Friability meter)		
Total protein (d.b)	13.5%	14.0%
Soluble protein	5-6%	5-6%
S/T ratio	40-44	40-44
Malt extract (minimum)	80%	78%
Wort viscosity (cp)	1.5	1.5
Wort turbidity	clear	clear
Diastatic power (L.V.)	80-120	90-130
Alpha amylase	Equal to or greater than check variety.	
Beta glucans	3.7-5.0%	3.7-5.0%
Dimethyl sulphide content	20-30 ppb	20-30 ppb

guidelines for barley breeders in India is given in Table 2.

Hops

The Hop (*Humulus lupulus*) is a climbing plant that is indigenous to Europe, Asia and North America. The female plant of hop bears green cones, which when ripened are used in brewing

to give bitter flavour. The Indian hop industry, which had been nurtured carefully throughout India had a tragic end due to fundamentalist movement in Kashmir. At present, hop is grown in Himachal Pradesh under 215 hectares spread over Lahuls and Spiti districts and the harvest for the year 1996 was 215 tonnes. However, the hop

production in India amounts to about 25% of the total required quantity, which is about 500 tonnes per annum. Indian breweries are mainly depending upon the imported hops, which mainly come from Europe, America and to some extent from Australia and New Zealand. Hop cultivation in India can be improved as most part of

Table 3 : Chemical Composition of Commercial Hops

Parameters	%
Water	8-21
Beta acids	2-12
Essential oils	0.5-1.5
Polyphenols	2-5
Monosaccharides	2
Pectins	2
Amino acids	0.1
Proteins	15.0
Lipids and wax	3.0
Ash	8-10
Cellulose, lignin etc.	40-5

the country favours the condition for successful hop growing. The requirements mainly include fertile soil, adequate day length, warm summer sun, water, adequate control of pests and diseases and well developed agricultural technology. The principal roles of hops in brewing are :

(i) To impart bitterness to beer; (ii) To provide the character-

istic hop aroma. (iii) To suppress growth of certain microorganisms; (iv) To assist foam stabilization in beer and (v) To contribute polyphenols to the proteins/polyphenol complex during wort boiling.

The brewing industry uses the hop products in the following forms :-

(a) Cone hops; (b) Hop pel-

lets; (c) Hop extract and (d) Hop oil

The typical chemical com-

Indian breweries are mainly depending upon the imported hops, which mainly come from Europe, America and to some extent from Australia and New Zealand.

position of commercial hops is given in Table 3. Table 4 shows the comparison of hops and hop extracts.

Brewing Adjuncts

i) **Maize** : The popularity of maize as a cereal grain has made its availability to the Indian brewers. Maize is being grown in most regions of the country and available in several forms for use

Table 4 : Comparison of Hops and Hop Extracts

Parameters	Hops	Alcohol Extract	Hezane extract	Methylene chloride extract	Typical Co ₂ Ext.
	%	%	%	%	%
Total resins	17.8	85.0	88.0	86.0	90
Soft resin	15.0-16.9	81.5	73.0	90	45
Alpha acids	8.2	38.0	45.0	40.0	
% alpha in total resin	46.6	44.7	51.5	46.5	50
% Hard resin as % of total resin	14.8	18.8	7.4	15.1	Nil

Table 5 : Comparative Analysis of Different Adjuncts

Parameters	Barley	Maize flakes	Broken rice	Sorghum
Moisture, %	10.5	12.8	11.0	11.7
% Extract (dry basis)	65	85	86	82
Oil, %	-	1.0	-	07
Proteins, %	9.8	7.6	8.4	10.4
Ash. %	1.0	0.4	0.6	1.6
Gelatinization Temperature, °C	60-64	65-75	70-78	69-75

in brewing. The gelatinized flakes or broken grits are mainly used in Indian breweries. Entry of maize starch and starch syrups to the Indian market is sure to make the brewers job more simple. Maize, when used in brewing, gives the characteristic taste and palate to the beer.

Rice : Rice in the form of whole grain or broken grain is an extensively used adjunct in brewing. It is used mostly to give the beer a smoother palate, mellowness as well as enhanced hop utilization and flavour. However, rice has the property of reducing the colour of the beer and hence its

use is being restricted. Table 5 gives the comparative analysis of different adjuncts.

Brewing Process

The brewing process involves :

- i) Milling ; ii) Mashing ; iii)

Table 6 : Physico-chemical Parameters of Lager and Strong Beer

Parameters	Lager	Strong
Specific gravity	1.006	1.010
pH	4.1	4.2
Colour, (EBC)	5.5-6.5	7.5-9.5
Clarity	Clear	Clear
Alcohol, % v/v	4.1-4.7	6.2-8.2
Bitterness, EBU	13-17	18.20
Nitrogen, mg/l	400	500
Amino nitrogen, mg/l	60-70	60-80
Carbohydrates, %	1-1.2	1.6-1.8
Carbondioxide, %w/w	0.55	0.55
Diacetyl, mg/l	less than 0.01	less than 0.01
Polyphenols, mg/l	60	70
Shelf-life, months	12	12
Head retention	90 sec	110 sec
Calorific value, Kcal/100 ml	30-40	40-50

Lautering ; iv) Wort boiling and v) Wort chilling.

Milling

Milling is carried out to prepare the malt by size reduction to the optimum condition required for the succeeding stages of brewing. Barley malt is milled in such a way that the husk of the grain is left substantially intact, while the contents of the husk become a very coarse flour (less than 0.9 mm).

Three types of milling process are followed in India.

i) *Dry milling* : Roller mills are used in dry milling. The size reduction rollers receive the malt from the feed rollers so that crushing occurs over the whole length of the corn, thus preserving the husk almost intact.

ii) *Wet milling* : The malt is conditioned with warm water in a hopper to raise the moisture content to about 30 - 35%. This is done with a purpose of reducing the shattering by two mill rollers. Lauter tun plate loadings of 280-330 kg/m² are claimed for the system.

iii) *Steep conditioned milling* : The 6 roller mill is preceded by a steam conditioning unit, which injects steam into the malt stream. Contact time is approximately 30 seconds, with the intention of increasing the moisture contents of the malt by 1%, the majority of this increase being concentrated in the husk.

Mashing

After milling, to obtain a satisfactory extract of the malt, mashing of the grits is carried out. The adjuncts are cooked before the process of mashing begins. As indicated in Table 5, gelatinization temperature of the various serial adjuncts is of critical importance in designing the mashing in temperatures. Depending upon the type of malt being used and the process capacity, three methods of mashing are followed. They are : (i) the infusion mashing, (ii) the decoction

mashing and (iii) the double mash system. The single temperature (60°C) mashing system is called infusion mashing. It is a simple, time tested and efficient system suitable for the conversion of well modified malt. In contrast, the multi temperature mashing system in which parts (usually one-third) of the mash are withdrawn in stages and boiled before being added back to the remaining mash to raise the temperature from 35°C to 65°C is called decoction mashing. The temperature of the mash is maintained at the optimum level for the effective action of amylolytic and proteolytic enzymes.

The physical stability of beer is enhanced by the addition of silica gel or polyvinyl polypyrrolidone (PVPP).

Lautering

The mash filtration is done through a vessel called lauter tun, which is generally placed at a higher level than other brewing vessels. It is an internationally accepted wort separation system for brew house operations. the main objectives of lauter tun operations are :-

i) High extract efficiency ; ii) Clear wort with low solids ; iii) Repeatable cycle time ; iv) Wort with low dissolved oxygen ; v) High mechanical efficiency ; vi) Low moisture spent grains and vii) Minimum effluent disposal.

It is worth mentioning that different brewing companies within the same market have radically different objectives, which are liable to change with market conditions, capacity constraints and raw material prices. Two impor-

tant aspects determining the lautering cycle time are wort recirculation and wort collection. Wort recirculation has an impact on wort quality, extract efficiency and cycle time. Wort collection is the productive phase of the cycle, which has the major influence on wort quality, extract efficiency and cycle time.

Wort Boiling

Wort boiling (100°C) systems are predominantly external vertical shell and tube units, which accomplish the following :-

a) Inactivation of enzymes to fix wort composition ; b) Sterilization of proteins ; c) Coagulation of proteins ; d) Hop extractions (isomerisation) ; e) Formation of flavour compounds and f) Evaporation of undesired volatiles.

The clear wort is boiled in the kettle for about 1.5-2 hours. This is a very intensive operation, wherein steam is used for indirectly heating the wort. It is at this stage of wort boiling at which various additives apart from Hop or Hop derivatives (Table 5) are used to contribute to the bitterness as well as aroma of worts, which ultimately emphasize the quality of the final beer. It is at the wort boil stage that various additions are made to wort such as sugar and materials, which encourage precipitation of protein and tannis from hops.

Several ways of reducing the energy consumption of the brew houses have been in practice. They include the reduction of the total evaporation rate from 8% to 4%, improved utilization of the energy of the kettle vapour and reduction of boiling time by means of higher temperatures and pressures.

Wort Cooling

After boiling, the wort is transferred to whirlpool, where the spent hops, precipitated proteins and other insoluble materials, referred to as "trub" are separated from the wort. The wort is rapidly cooled in a plate heat exchanger.

During cooling, proteins and tannins are precipitated as a fine coagulum referred to as the "cold break". The purpose of 'hot and cold breaks' is to reduce the material present that could later precipitate in the material present that could later precipitate in the finished beer as a haze. During wort cooling, aeration of the wort is carried out to achieve dissolved oxygen level of 8 mg/l to permit the yeast to ferment efficiently. Brewer's yeast is pitched to the wort generally at the beginning of wort cooling.

Fermentation

Stringent process control at the fermentation stage has led to significant development in the brewing industry. Most of the brewers depend on the yeast strains from abroad, as they have not yet been convinced of the quality of the yeast strains supplied by Indian laboratories.

In general, the fermenters are cylindro-conical in shape. The new concept in tank design is the unitanks, which are used both as fermentation and storage tanks. Installation of unitanks considerably reduces the beer loss, time loss, energy consumption and manpower. The option to have them installed out-doors is very attractive.

The classical cooling configuration for a unitank consists of :-

- A cone cooling zone : 2-3 shell cooling zones in the area of the fermentation volume.

The operation of the individual zones is process dependent in each brewery. A common practice is :- i) use of upper shell cooling zones during main fermentation. ii) For cooling down, use of all cooling zones with successive shut-off in the final phase and iii) Use of conical zone or lower shell cooling zone for maintaining the maturation temperature of 0 to 1°C.

Lagering

It is the process of holding beer in a tank at refrigerated temperatures (0°C) for a period of time following fermentation. Storage periods range from 1-4 weeks for lagers. The following

The open economic policies have paved the way for Indian breweries to enter into foreign market and meeting the stringent quality demands set by them.

process functions take place during lagering :

- i) Flavour maturation ; ii) Chill-proofing and stabilization ;

To achieve the ideals of quality control, great emphasis should be on ensuring at every stage within the process, that the customer receives the best desired product.

- iii) Clarification and filtration ; and iv) Carbonation.

Flavour maturation occurs in the presence of residual amounts of yeast fermentation. The physical stability of beer is enhanced by the addition of silica gel or polyvinyl polypyrrolidone

(PVPP). The stability of beer (physical, flavour and foam) has assumed increasing importance in the recent days and measures to increase stability are usually taken during lagering. Addition of antioxidants at this stage of process removes molecular oxygen from beer, which can cause flavour instability.

Filtration

The varied climatic conditions throughout India have made beer filtration to be very traditional, and all attention is given at this stage of the process. Prolonged shelf-life to Indian beer is a must, as beer is transported to very long distances and the storage conditions are very adverse. Presently, sheet filters are being used for filtering and polishing the beer. It is a practice of some brewers to use double filtration in order to improve the shelf-life of the product.

The filtered beer is carbonated as per the market specifications and chilled to 0°C before storage in bright beer tanks for about 24 hours prior to bottling.

Packaging

Beer for Indian market is generally packed in glass bottles of either 330 ml or 650 ml capacity of which the latter is very predominant. The cleaned bottles are filled using automatic beer fillers and pasteurized to improve shelf-life and the keeping quality of the product. The dry packaging part of the beer industry is becoming more competitive and attractive. This has ensured many a breweries very good market image. The open economic policies have paved the way for Indian breweries to enter into foreign market and meeting the stringent quality demands set by them. Most of the breweries have almost semi to fully automatic packaging system. The beer bottle decoration has become a deciding factor in establishing the premium image of the product in the market.

Bottles have been decorated with a body label, a back label, a neck label or neck foiling. Of late, canned beer is becoming popular owing to its added advantage of easy and safe transport by the customer. However, the cost factor or beer canning is the major constraint in replacing beer bottles by cans. Packaging of labelled beer bottles in attractive corrugated boxes is the finishing touch to the process of brewing industry.

Quality Control in Breweries

Quality could be taken to equate to the achievement of consistency and the elimination of unwanted surprises. With respect to beer, quality is defined in all of its attributes viz., appearance, flavour and price.

To achieve the ideals of quality control, great emphasis should be on ensuring at every stage within the process, that the customer receives the best desired product. Table 6 shows the physico-chemical parameters of beer. In other words, if the raw materials are right and the process, which concerns them is controlled, the product of that process will be right too. Emphasis should be on installing systems and strategies to ensure that the product is right at

each stage. Quality monitoring provides measurements against which a process can be adjusted immediately. For example, the measurement of yeast count and viability at pitching, microbiological data are important factors during process. Analysis of certain parameters have less immediate value but give information that is more likely to be responded to over a longer time scale. Example include the free amino nitrogen levels in wort and free beta glucon level in malt, and dimethyl sulphide in beer.

The Future

India is making giant strides towards integration with the global economy, which is expected to bring considerable benefits to industry and the consumer through modernization, cost efficiency and fresh investment. The Indian beer market has shown steady growth over the past 10 years, with the forecast suggesting a cumulative 50% increase over the next five years.

One development, which could have a significant influence on market growth, is draught beer and the pub concept, not so much for its volume effect as for the image of beer drinking generally as an acceptable recreational pursuit. There are more than 150 pubs in

Bangalore, a city which has the reputation as the "pub capital" of India. The spread of such facilities to other cities, where a new generation of Indian youth can enjoy the social ambience of beer drinking could have a profound effect on the image of the industry and its potential for growth.

One bottle beer contains about 280 calories. In addition, it contains calcium, potassium, magnesium and phosphorus. Beer has got vitamin B₁, B₂, niacin and pantothenic acid. These nutritional values automatically qualify beer as a healthy drink.

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Membrane Technology for Fruit and Vegetable Juice Industry

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Introduction

With the inception of new composite membranes and tubular system, reverse osmosis (RO) and ultrafiltration (UF) are now being used extensively in food and dairy industries.

RO is a single phase concentration process, which uses a pressure gradient across a semi-permeable membrane to squeeze water through membrane, retailing most compounds including low molecular weight organics and salts. Since, there is no phase change, the RO process of concentration is extremely energy efficient compared to both evaporation and freeze concentration. RO can operate over a wide temperature range from 5⁰ to 80⁰C. Low temperature RO is an effective process to avoid heat spoilage of some products such as fruit juices.

Ultrafiltration is a related process but uses much lower pressure, typically 1 to 10 bars and much more open membranes, which pass salts, sugar and organics in the molecular weight range typically from 5000 to 100,000 depending on the membrane type. It is limited by osmotic pressures, since the sugars are not concentrated. Both RO and UF have promising uses in fruit and vegetable juice industry as an unit operation for concentration or

aroma recovery and clarification of juices, respectively.

Fruit Juice Concentration and Clarification

Traditional methods of fruit juice production involve several batch operations, which are labour and time consuming. In a typical traditional setup, after preliminary

to hydrolyze the pectin and reduce the cloudiness. The enzyme treatment also makes the subsequent filtration easier presumably by lowering the juice viscosity. The preliminary clarification, where a fining agent such as gelatine is added and juice is held for 20-40 hours after decanting, the juice goes for precoat filtration, using diatomaceous earth as filter aids.

The primary goal of UF in fruit industry is to replace the holding, filtration and decantation steps of traditional process. Moreover, while clarifying the juice with UF-process, very small quantity of enzyme (pectinase) to the order of one-third to one-fourth of quantity used in traditional process, is required. Enzyme treatment in this case is required only to reduce viscosity of juice by partially hydrolyzing the pectin mainly to improve the performance of UF-unit by evident increase in flux rate.

Juice Clarification Using UF-Process

Membrane : The clarification process essentially a process to remove pectin, enzyme and other fibrous micromolecules from sugars and flavour components, constituting the clear juice. To separate these molecules, a semi-permeable membrane made of a polysulphone in cut-off range of

With the inception of new composite membranes and tubular system, reverse osmosis (RO) and ultrafiltration (UF) are now being used extensively in food and dairy industries.

sorting/handling/washing, peeling steps, depending on the fruit, the fruit is crushed and sent through presses and screens to remove the large particulates. If a clear juice is to be produced, the press juice is pasteurized, then treated with an enzyme (pectinase)

20,000-25,000 is required. The temperature of UF may be high (50-55°C) or low (10-15°C) depending on the type of juice and thermal sensitivity.

Module : For viscous partially depectinized juice, it is advisable to use tubular module UF-system. When thin-channel or hollow fibre UF-system is to be used, some-pre-filtration of juice is necessary, usually with 80-mesh screen.

Typically, pressures of 3-20 bar is used in UF-clarification process, which is produced with the help of centrifugal and positive displacement pumps.

Systems : Since fruit juices have very low level of retained solids, the optimum mode of operation is the batch operation with partial recycle of retentate, i.e., where the bulk of the retentate is within the recycle loop and a small portion is used to 'top off' 'the feed tank'. This should offer considerable savings over multi-stage recycle systems. Further savings in capital cost and reduction in holdup volume can be attained by judicious arrangement of modules in series and in parallel.

The pectinase-treated juice gives permeability (flux) in the range of 120-130 litres./m²/hr.

Retentate and Permeate

In the process of manufacturing clear single-strength juice by UF, the permeate (sugars and flavour components, minerals, water, vitamins etc.) is the desired product stream. The ultrafiltered permeate, the product of this process is eventually sterile and if handled carefully and in an aseptic manner, it should not require a subsequent treatment prior to storage or bottling.

Evocative Case Studies

Apple Juice UF

The UF process produces a high quality, clear juice from depectinised apple juice feed in a

single step.

The capital costs of equipment and the hold-up volume of apple juice in conventional sedimentation centrifuge, filter press (with filter aids) and final

The clarification process essentially a process to remove pectin, enzyme and other fibrous micromolecules from sugars and flavour components, constituting the clear juice.

filter press sequence is reduced to a rapid single step process.

Each fruit juice manufacturer has different operating techniques and costs, but the ultrafiltration process generates cost savings and man-power reduction in :

Reverse osmosis occurs, when pressure greater than the osmosis pressure is exerted on a solution in contact with a semi-permeable membrane.

(i) The quantity of enzymes required to depectinise the apple juice; (ii) Filter aids, bentonite, and final filtration step; (iii) Improved overall extraction efficiency typically 97% against 90- 93% typical for traditional process and (iv)

No holding for 20-30 hours for fining process, the bottling can be carried out within 2 hours after start-up.

Lime Juice UF

Lime juice is usually clarified on a single stage, batch UF process. This process illustrates the potential for UF process, to recover a valuable secondary product as in this case, the lime juice essential oil fraction, by a low temperature, non-heat degrading process. The recovery of clear juice is typically in the range 88-95%.

The other fruit juices from cranberry, pear and grape are also being clarified using UF process.

Juice Concentration Using RO

Reverse osmosis occurs, when pressure greater than the osmosis pressure is exerted on a solution in contact with a semi-permeable membrane. Water flows through the membrane and the solution retained by the membrane is concentrated.

The process occurs in the liquid phase at ambient or higher temperature and uses energy more efficiently than processes, which involve a change of phase.

The advantages in concentrating fruit juices using a low cost, energy efficient process combined with minimum heat damage to colour, aroma and viscosity characteristics of juice, were first noted in work on orange and apple juice by Merson and Morgan (1968) and on grape fruit, apple and orange juice by Gheradi *et al* (1972).

Membrane : Cellulose acetate membranes used in concentration of orange juice retained oil-soluble aromas, but still higher membranes are required to retain the water-soluble esters, alcohols, aldehydes and acids.

Retention of water soluble aroma compounds has been possible with ZF 99 (manufactured by

Peterson Candy International (PCI) Ltd, England) in tubular form with combination of high fluxes and chemical and physical stability of membranes.

Modules : Tubular configuration is highly suitable for fruit and vegetable juice concentration. It permits operation at uniform high solution flow velocities to minimize fouling and allow cleaning-in-place. Tubular modules can concentrate raw as well as clear juices, which perhaps are not possible with hollow fibre or plate and frame system. The typical operating pressures of 40-70 bars are required in concentration of fruit juice upto 8.5° Brix.

Advantages

Reverse osmosis is predominately used as a energy saving device for pre-concentrating the fruit juice upto 8.5° Brix. It has virtually the following advantages : (i) Uses only electrical energy to raise the pressure of juice feed; (ii) Total operating costs are typically 5 to 10 times lower than normal evaporators; (iii) Process control is simple and product Brix level is automatically controlled; (iv) No cooling water equipment is needed and (v) Passato (tomato paste) type products (6-8.5° Brix) made by RO has better flavour, colour and better nutritive value.

Typical Industrial Applications

Tomato Juice Concentration by RO

Currently, there are a number of installations in operation in Italy, Spain and France, concentrating juice 8 to 9% NTSS, using RO process. The RO concentrate (6-8.5 Brix) is packaged, as a product called "Passato" or 'Belle Tomato'.

The Passato is the base product for tomato sauces such as chilli or pizza, as well as for soups and drinks. It has been observed that Passato produced by reverse osmosis has a redder colour, since

browning is minimized. It has a higher viscosity for given solids content and the flavour is closer to fresh tomatoes. Passato was only known in Italy, but now it is a product that is gaining popularity in Europe and may well eventually replace canned tomatoes for culinary purposes.

Case Study

In 1984, one large RO tomato concentration plant was installed by PCI, England in Coper, Ravarino, Italy for production of 'Passato'. The plant was capable of producing continuously an 8.5° Brix product from a 37.5 or 25m³/hr feed tomato juice (4.5-5° Brix). The RO product was pasteurized and either bottled as 'Passato' product or stored in sterile storage tanks. In this 4 stage RO plant, the operating costs included about 175 kw electrical power and membrane replacement cost, to give a total operating cost of £ 1.15-1.30/m³ water removed. The existing evaporator had an operating cost (steam plus electrical power) of 17.25 per m³ of water removed. At maximum capacity, the RO plant removed 17.65 m³/hr of water, with a calculated saving in a 50 day season, of over £120000 or US \$ 199,200.

According to Pepper and Orchard (1985), the technical advantages of RO product as an 8-8.5° Brix Passato product, compared to the original product produced by evaporation have been : (i) Improved colour compared to evaporator product; (ii) No loss of sugars, salts and important flavour components, amino acids etc. as these are retained by RO system, which improves flavour and recovery of product and (iii) Increased viscosity (10-25%), because of decreased heat damage.

In another processing plant in Italy, the three stage PCI, RO plant has total capacity of 126 m³/hr of 4.5° Brix tomato juice feed. RO plant removes 59.3m³/hr of water in pre-con-

centrating tomato juice to 8.5° Brix. The two evaporators then remove the final 47.1 m³/hr of water to produce 28-30° Brix product. The total saving of 50 days processing using RO in preconcentration have been calculated as £ 400,000 or US \$ 664,000. In economic terms, the payback period for RO plant has been calculated as less than three year.

Orange Juice RO

It has been confirmed by independent expert taste panels that the 20° Brix RO product re-diluted to 11-12° Brix feed strength retains all natural orange juice characteristics of taste and flavour.

In addition to the advantages of low cost pre-concentration, economic savings and factory capacity expansion, the low cost RO pre-concentrate at 17-20° Brix can be concentrated to 40-65° Brix by flash evaporator and the very high steam usage (typical efficiency is 1.1 kg steam per kg water evaporated) may be reduced to between 40-60% of the existing cost for the same production rate. In order to reduce heat degradation to a minimum, orange juice RO is carried out typically between 20-30°C.

Apple Juice RO

Apple juice can be concentrated using PCI tubular module at 30- 50°C. The depectinised apple juice (clear juice) can be economically concentrated to 20-25° Brix. The retention of sugar and flavouring components such as ethyl-2- methyl butyrate, malic acid, citric acid, calcium, potassium, fructose, glucose has been in the range of 95 to 99%. According to an estimate, a RO plant, which concentrates 8000 litres/hr of apple juice from 10° to 20° Brix has the following typical cost figures (in US \$).

Capital cost	315,400
Operating costs (assuming 2000 hours per season)	
(a) Membrane (over 3 seasons) :	14,440

(b) Electricity (40 kw at L 0.04/kwh) :	6,142
(c) Cleaning chemicals :	1,660
Total :	22,242
Cost of water removal =	$2.22/\text{m}^3$

Beet Juice RO

It is now possible to concentrate raw beet juice, thin beet juice and steffens filtrate (diluted molasses with 3.5% solids) using tubular polysulphone RO membranes at 60-70°C from 15° Brix to 30° Brix. Typically optimum pressure for RO of beet juice is 55-60 bars at 60°C, with a flux of 30-35 kg/m²/hr. The flow velocity is kept at 2m/sec.

It is quite easy to perform RO on thin beet juice upto 30° Brix with two stage RO recirculation system. However, raw juice with ample amount of fibre, grit and clay, damages the piston pump, suction valves and the mechanical seals on the recirculation pumps. For this reason, raw juice has been pre-filtered through a coarse 650 micron bag filter before feeding to RO system. It has been observed that fluxes during concentration do not deteriorate significantly over runs upto 20 hours duration. The most likely source of fouling has been the calcium salts.

The polysulphone membranes after beet juice RO concentration are cleaned satisfactorily with little change in initial water flux with following cleaning cycle :

- 0.3% by weight nitric acid at 40-50°C for 30 min;
- rinse with water at 50°C for 10 min
- 0.25% NaOH at 40-50°C for 30 min;
- rinse with water at 50°C in 10 mins and
- sterilization with 500

ppm H₂O₂.

Economics of Beet Juice RO

The figures are based on typical plant with the capacity to feed 200 m³/hr of thin juice and concentration from 14° Brix to 26° Brix. The following operating and running costs are based on running the plant for 24 hours a day for 20 days removing 93 m³/hr. of water. (figures in US \$).

Capital Cost : 415,000 to 2,905,000

There are few Indian manufacturers supplying tubular and spiral-wound UF modules, which are worth trying for clarification of fruit juices after proper standardization.

Main Operating Costs

a) Membrane replacement cost (after 6000 hrs.) = $0.60/\text{m}^3/\text{WR}$ (water removed)

b) Power 600 kw/hr .
= $0.38/\text{m}^3/\text{WR}$
Total = $0.98/\text{m}^3/\text{WR}$

In equivalent energy terms, RO requires less than one-tenth the energy required by a 6-effect evaporator for the same level of concentration.

Conclusion

In recent years, ultrafiltration has become an economically viable alternative for clarification of a wide variety of fruit juices in comparison to conventional method of clarification. Both technology and membrane systems are now available in international market mainly from Europe, USA and Japan. There are few Indian manufacturers supplying tubular and spiral-wound UF modules which are worth trying for clarification of fruit juices after proper standardization.

Reverse osmosis is a well established process now for concentration or preconcentration of raw and clear depectinized juice from fruits and vegetables. It is established beyond doubt that this process consumes 10 times less energy for removing water, when compared with conventional evaporators, nevertheless with limitation of concentration level. Technologies have already been standardized for concentration of tomato juice, orange juice, apple juice and beet juice.

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Problems and Prospects of Cryogenic Freezing in Food Industry

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Cryogenic freezing is the front line technology, which has tremendous potential of answering various problems confronting food processing and transportation. The term 'cryogenic freezing' refers to very rapid freezing achieved by exposing food items, unpackaged or thinly packaged to an extremely cold refrigerant, undergoing a change of state in general. In it, the temperature range is from -100°C to absolute zero, which separates it from the temperature range generally used in mechanical refrigeration. This is the range where the so-called permanent gases liquefy, where the metals become super-conductive and living cells pass into a state of suspended animation. The cryogenic gases are those gases, which account for most of cryogenic research and application and are oxygen, nitrogen, hydrogen and helium.

Cryogenic freezing assumes all the more importance in view of the Montreal Pact, in which the use of CFC and HCFC compounds are being phased out in accordance with international agreement and national legislation and this, in turn, calls for concerned efforts

and hectic search for alternatives. Liquid nitrogen is more eco-friendly and does not cause harm to sensitive ozone layer, which is a major cause of concern in Montreal Pact.

The term 'cryogenic freezing' refers to very rapid freezing achieved by exposing food items, unpackaged or thinly packaged to an extremely cold refrigerant, undergoing a change of state in general.

Scope

Though the major application of cryogenic technology is in the area of space simulation, source of energy, rocket propulsion system, studies in high energy

physics, nuclear engineering application, electronics, medicinal and mechanical design, yet the scope for application of cryogenic technology for the storing and processing of horticultural crops and livestock products is no less important. It has best to offer for increased demand and requirement for individually quick frozen (IQF) ingredients of high quality, with free flow characteristics to aid portioning, ease of handling and stock control. These applications are limited to certain class of society and the technology options are very few. They are not cost-sensitive and have no economic bearing i.e., investment to return. Further, in case, liquid nitrogen is available as a by-product and the transport cost is not prohibiting, processing of fruits, vegetables and marine products can be a viable option as a spin off. Some work in producing crack-free mango slices, undertaken at IARI led to a standardized method called cycling dip. But still more research efforts are needed for standardizing machinery, equipment and methodology for such techniques.

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Advantages and limitations

Cryogenic freezing offers a wide range of unique benefits, including high cooling rates, high throughputs (low floor space), flexibility (adaptable to different products), low capital entry, low dehydration loss and better quality. These advantages have driven the growth of the technique so much that an estimated 10% of all frozen food in UK is now frozen on cryogenic freezers. Cryogenic technology has found application for the industrial scale production of frozen solid and liquid food stuff. Processes are now available to meet the existing needs of food industry.

The limitation of cryogenic freezing is that the present cost of liquid nitrogen is high because of power intensive production. The product has to be transported from the place of its production, which adds to its cost. These limitations can be overcome, if efforts are made to produce liquid nitrogen by alternate technologies and more units are established at points, where there are applications with thrust and encouragement for increasing the horticultural produce. Besides these, there is a great risk of suffocation to the employees. Also, freezing with liquid nitrogen is not suited for fruits like grapes, plums, beans and tomatoes and leafy vegetables having high water content.

In industrialized nations, where cryogenic technology is widely used in industry or space application and where large quantities of liquid nitrogen is available for use, the use of the source for food or crop preservation is a spin off benefit rather than a thrust area. The bulk production of liquid nitrogen will make the product economical for use. Thus, the cryogenic industry has wide scope for diversification with both backward and forward integration.

The cryogenic technology

using liquid nitrogen as an option is more expensive than conventional refrigeration. Unless the volume of operation warrants the particular option, in developed countries, where over 70% of the produce is processed, it is a viable option. But in a country like India, where less than 1% is processed,

The limitation of cryogenic freezing is that the present cost of liquid nitrogen is high because of power intensive production.

the option is not attractive.

However, if indigenous capability for developing software and hardware gets impetus, coupled with an increase in industrial and research application, the scope for cryogenic freezing will widen.

One of the major factors in the option of cryogenic technology is the energy consumption.

Capital Outlays

The cost of conventional cold storage works out between Rs. 3000/- and Rs. 5000/ tonne of capacity created depending on the unit. The capital cost generally includes the cost of civil works/panels/chilling unit, initial cost of refrigerant, electrical fittings etc. The cold storage chambers are now available in modular designs

having prefabricated insulated panels, with imported cooling units. These are easy to transport, expandable and can be shifted to different locations. The conventional cold storage units are built with brick and cement with additional insulation and connected to a chilling unit. Such units are more economical than those of modular units, though the running and maintenance costs of such units are much higher.

The capital cost of setting up of a liquid nitrogen-based freezing unit would be about one-third of the cold storage units, as drive motors, compressors, chilling units etc. are not involved.

Thus, the cryogenic technology will work out to be 30% cheaper than the conventional storage in capital cost and if liquid nitrogen is available within 200 km of the unit, the cryogenic technology may find application in India too.

Energy Requirements

One of the major factors in the option of cryogenic technology is the energy consumption. In a developing country like ours, uninterrupted power supply is a major limitation and alternate sources of energies have to be considered. Various operations in food processing require different energy levels e.g., canning requires 5250 kwh, while freezing requires 3200 kwh of power. Hence, canning is more intensive than freezing and the cost of transport is also high as weight of water and metal container is also included. The cryogenic technology is highly energy-intensive as over 2000 kw of power is required to freeze each tonne of the product, taking into consideration the electricity required to produce liquid nitrogen and the fact that it cannot be recovered. Also, cryogenic technology involves steps, which can lead to leakages causing energy loss.

Conclusion

Cryogenic freezing furnishes attractive alternative to introduce delicate flavours of mango and litchi in European markets. Apart from these, high value commodities like mushrooms, meat products, marine foods, fish and prawn, also hold good promise. Another potential area is communiton. The value of cryogenic grinding in the retention of volatiles, in the grinding of spices is well known. Though cryogenics are being economically applied in transportation and food processing industries in developed countries, much is yet to be done in our country. With the ever increasing consumption of frozen foods, driven by changing life styles and the emphasis on high quality of additive-free foodstuff, cryogenic technology will continue

to offer solution to the challenges to the food industry.

**Though cryogenics
are being
economically
applied in
transportation and
food processing
industries in
developed countries,
much is yet to be
done in our country.**

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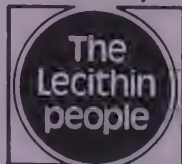
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Modified Starches and Their Use by Food Industry

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Introduction

Why are starches modified ? Starch, as it occurs in nature, may not have the functionalities, which would make it useful in a particular application. Modifications of the native starch, either physical or chemical, can provide the molecular properties, which overcome these deficiencies. The range of applications in which starch can be used is increased by such modifications.

Modifications of native starch are designed to change one or more of the following properties: (i) Gelatinization temperature and cooking characteristics; (ii) Solids-viscosity relationships; (iii) Retrogradation characteristics; (iv) Ionic character; (v) Hydrophobic/hydrophilic characteristics; (vi) Resistance to changes in viscosity of pastes due to acid conditions (vii) Resistance to changes in viscosity of pastes due to mechanical shear and (viii) Resistance to changes in viscosity of pastes due to high temperature.

Methods of Modification

Modification of starch can be done by three methods viz.,

(i) Physical changes ; (ii) Degradation of the starch molecule (converted starches) and (iii) Addition of a chemical group

Table 1 gives the various types of starch modification

Pre-gelatinized Starches

Pre-gelatinized starches are starches, which have been cooked and then dried. The products are swellable in cold liquids. Pre-gelatinized starches are produced by drying starch suspensions or starch pastes on heated rolls (drum/roll dryers), or by extrusion of semi-dried starches. The starch

Modification of starch can be done by three methods viz., (i) Physical changes ; (ii) Degradation of the starch molecule (converted starches) and (iii) Addition of a chemical group.

used for pre-gelatinization could be either native starch or starch, which has been chemically treated either to degrade it or to add on a chemical group. The pre-gelatinized starch essentially retains the properties of the starch used for pre-gelatinization except for being swellable in cold water. The

rate of hydration and the texture of pastes can be varied by processing techniques and physical form. Coarse powders, for example, will give a pulpy texture.

Typical applications of pre-gelatinized starches are in convenience foods, e.g., instant puddings and other products, e.g., instant laundry starch and in industrial situations, where cooking may be a constraint, e.g., wet-end additives in paper and in drilling mud.

Low Viscosity Starches (Converted Starches)

These are the earliest modifications to have been commercially practised. With native starches, it is not possible to produce pastes at concentrations above 10%, usually lower, which can be handled conveniently. In many applications, in adhesives, for example, high solid levels are required so that the amount of water to be removed is less, resulting in faster drying and lower energy consumption.

Low viscosity starches are produced by chemical treatment, which results in scission of some of the glucosidic bonds. The commercial processes for the production of low viscosity starches are :

(i) Acid and heat treatment of dry starch (pyrodextrins) ; (ii) Acid treatment of starch in water

Table 1. Various Types of Starch Modification

Type of modification	Purpose of modification	Treatment
Pregelatinized starch	Cold water dispersibility	Drum/roll drying; extrusion
Low viscosity starches		
Dextrins	Lower viscosity; improved tackiness,	Dry heat treatment, with/without acid
Acid modified starch	Lower viscosity, high gel tendency	Acid hydrolysis of starch suspensions
Oxidized starch	Lower viscosity, improved viscosity stability	Oxidation of starch suspensions
Enzyme-modified starch	Lower viscosity	Bacterial alpha-amylase on starch pastes
Cross-linked (Inhibited) starch	Modification of cooking characteristics, resistance to acid, enzymes, shear	Cross-linking with bi-, multi functional agents in starch suspensions
Introduction of chemical group(s) (Stabilized starches)	Improved viscosity stability, improved mouth feel, change in ionic character, making the molecule hydrophobic, etc	Esterification, etherification

Table 2. Relative Viscosity of Various Starches and Low Viscosity Starches

Starch product	Low	Relative viscosity	High
Native starches			
Potato			
Waxy maize			_____
Tapioca			_____
Maize			_____
Wheat			_____
Modified starches			
Oxidized			
Thin-boiling		_____	
Enzyme-thinned		_____	
White dextrin		_____	
Yellow dextrin		_____	

slurries (acid-modified starches, thin boiling starches, fluidity starches) ; (iii) Oxidizing agents (oxidized starch) ; (iv) Enzyme treatment, normally bacterial α -amylase (enzyme-thinned starch).

Table 2 gives an indication of the relative viscosity of various starches.

Pyrodextrins are of three types viz., white dextrins, yellow dextrins, and British gums. They are produced by a process called dextrinization. The name dextrin is derived from the fact that the product is dextro-rotatory (optical rotation). Dextrins are prepared by roasting of dry starch, usually with acid as a catalyst. The acid normally used is hydrochloric acid, either as a gas or in solution. During dextrinization, the starch molecules are first hydrolyzed to shorter fragments. Subsequently, the fragments recombine to bush-like structures.

White dextrins are produced by converting at relatively low temperatures, depending on low pH to promote conversion without colour formation. Yellow dextrins, on the other hand, are highly converted products made by a combination of low pH and high temperature. British gums are produced at relatively high pH and depend on high temperature for conversion.

The production of pyrodextrin can be broken down into four major steps :

(i) Pre-treatment as by acidification ; (ii) Pre-drying ; (iii) Heating or pyroconverting and (iv) Cooling.

Depending on the type of equipment available, these may constitute distinct individual steps, or may be combined into as few as two steps. This impacts on the quality of the dextrin produced. In India, most dextrin manufacturing processes comprise two steps and the conditions of roasting are not always controlled, leading to the variations in product attributes.

Thin-boiling starches (fluidity starches), of a type, were first described by C.J. Lintner in 1886. The Linter starch is still used in laboratories as an indicator in iodometric titration. Thin-boiling

Oxidized starches are produced by reacting starch in suspension with oxidizing agents, usually sodium hypochlorite.

starches, as are available commercially, were reported in about 1900. Starch is suspended in dilute acid solution (usually hydrochloric or sulphuric) and maintained at a temperature below the gelatinization temperature till such times as the required viscosity/fluidity is obtained. The

Cross-linked starches, with inhibited swelling and resistance to shear, temperature and acidity are used as a base material of esterification, which results in slow retrogradation.

suspension is then neutralized with alkali, the starch collected, washed and then dried.

The thin-boiling starches prepared by the suspension process differ from native starch in that they have a lower paste viscosity. Also, pastes have an increased tendency to increase in

viscosity and form a gel upon cooling and standing. This is due to the fact that the acid treatment results in an increased number of linear molecules and is the reason why these starches are used in the manufacture of gelled confectionery.

Thin-boiling starches are usually evaluated on a fluidity scale, where zero corresponds, in theory, to native starch and 100 corresponds to a starch with the viscosity of water. In practice, it is possible to go beyond a fluidity of 90, as beyond that the solubilization of the starch is considerable.

Oxidized starches are produced by reacting starch in suspension with oxidizing agents, usually sodium hypochlorite. Oxidation is the only instance in which one treatment causes two important chemical changes : depolymerization and the introduction of carboxyl groups. The carbonyl and carboxyl groups formed in the amylose chains are mainly responsible for the decreased tendency of oxidized starch pastes to retrograde and gel.

The commercial production of oxidized starch involves treating an aqueous starch suspension of about 35% solids with sodium hypochlorite solution (containing 5-10% available chlorine), at an alkaline pH, at about 30-35°C. When the required level of oxidation is reached, the reaction mixture is neutralized, the starch is washed to remove soluble impurities, collected and dried.

Oxidized starches are anionic. As stated earlier, they have a lower hot-paste-viscosity and are more stable to retrogradation. They have a lower gelatinization temperature and a lower peak viscosity. Oxidized starch pastes have higher clarity, but their films have a lower tensile strength. They are whiter than the starch from which they are produced.

Enzyme thinned is produced by passing a starch slurry

containing heat-stable bacterial alpha-amylase through a jet cooker. The gelatinized and partly thinned starch paste is passed through holding coils to obtain the required viscosity. The enzyme is then inactivated by a second pass through a jet cooker at elevated temperature, after which the thinned paste is ready for use.

Cross-linked Starches

One of the most important starch modifications is that resulting from the action of bi- and polyfunctional reagents such as phosphorus oxychloride, trimeta phosphate, adipic acid and epichlorohydrin. The action of borax on starch pastes, which results in increased viscosity and stability, is also a case of weak cross-links. They react with more than one hydroxy group, thus linking one starch molecule with another. Treatment of ungelatinized granules under appropriate conditions results in toughening of the granule, making it more and more resistant to gelatinization as the degree of cross-linking increases.

In most applications, a low level of cross-linking is used, about one cross-link per 100 anhydroglucose units. As stated earlier, cross-bonded starch differs from native starch in their resistance to swelling and gelatinization. At low levels of cross-linking, a higher cooked paste viscosity is attained. The pastes have an increased resistance to changes in their viscosity due to shear, heat, and acidic conditions. Cross-linking improves the mouthfeel of certain starches such as waxy starch. Pastes of native waxy starch are "cohesive, rubbery and elastic"; after cross-linking, they are "smooth, salve-like, and creamy."

Stabilized Starches

The reaction with starch with etherifying or esterifying reagents results in the introduction of side chains onto the amylose

molecules, resulting in irregularities in the linear structure. This results in the inhibition of the formation of ordered structures in the starch pastes, thus retarding retrogradation. Because of the increased viscosity stability thus

Starches are generally added to foods not as a source of nutrition, but for the functional properties that they contribute.

imparted, these starches are referred to as stabilized starches.

The common starch esters are monostarch phosphate (prepared using phosphoric acid or water soluble salts of ortho-, pyro- and tripolyphosphoric acid). Starch acetate (prepared using acetic anhydride or vinyl acetate) and starch octenylsuccinate

Acid-hydrolyzed fluidity starches are used as gelling agents in the manufacture of gum jellies such as jelly beans, gummy bears and orange slices.

(prepared using octenyl succinic anhydride). In the last mentioned case, the introduction of hydrophobic groups imparts hydrophobic properties to the starch without destroying water dispersibility. The hydrophobic-

hydrophilic balance imparts useful emulsifying and emulsion stabilizing properties.

The common starch ethers are hydroxyethyl starch (reaction with ethylene oxide), hydroxypropyl starch (reaction with propylene oxide), carboxymethyl starch (reaction with monochloroacetic acid), cationic starches (usually using the quaternary compound, chloropropyltrimethylammonium chloride). All these reactions require the presence of high concentration of alkaline catalyst (sodium hydroxide). Hence, the slurry reaction is usually done in the presence of sodium chloride or sulphate to prevent swelling of the starch granules.

While carboxymethyl starch is anionic, hydroxyethyl and hydroxypropyl starch are non-ionic. As stated earlier, the introduction of a substituent reduces the tendency to retrograde. Not all substituents are equally effective, the longer substituents being more effective than the shorter ones. All the ethers have a lower gelatinization temperature. The dried starch films have increased solubility, clearer and more flexible films and more continuous films.

Combination of Treatments

A single type of modification may not be enough to impart the functionality required in a starch for a particular application. Cross-linked starches, with inhibited swelling and resistance to shear, temperature and acidity are used as a base material of esterification, which results in slow retrogradation. Acetylated di-starch phosphate is an example of such a starch. When starch pastes of low viscosity, but which are stable, are required, stabilization by esterification or etherification and acid hydrolysis or oxidation may be combined. Mixed cationic-anionic starch derivatives

Table 3 : Chemical Modifications of Starch Permitted in Food (U.S.A.)

Modified starch	Treatment permitted	Residuals limitation
Thin boiling, acid modified	Hydrochloric or sulphuric acid	None
Gelatinize (alkaline)	Sodium hydroxide, not to exceed 1%	None
Acetylated distarch	Acrolein, not to exceed 0.6% & vinyl acetate, not to exceed 7.5%	Not more than 2.5% acetyl groups in the finished product
glycerol		-do-
-do-	Epichlorohydrin, not to exceed 0.3%, & acetic anhydride	None
Succinyl distarch	Epichlorohydrin, not to exceed 0.3%, & succinic anhydride not to exceed 4%	None
glycerol	Phosphorus oxychloride, not to exceed 0.1%, & propylene oxide, not to exceed 10%	Not more than 5 ppm of residual propylene chlorohydrin
Hydroxypropyl distarch phosphate		-do-
Oxidized hydroxypropyl starch	Chlorine, as sodium hypochlorite, not to exceed 25 g of chlorine per 454 g of dry starch; active oxygen obtained hydrogen peroxide, not to exceed 0.45% ; & propylene oxide not to exceed 25%	
Bleached starch	1. Hydrogen peroxide and /or peracetic acid, not to exceed 0.45% of active oxygen	1. None
	2. Ammonium persulphate, not to exceed 0.075%, and sulphur dioxide not to exceed 0.05 %	2. None
	3. Chlorine, as sodium hypochlorite, not to exceed 3.72g of chlorine per 454 g of dry starch	3. None
	4. Potassium permanganate, not to exceed 0.2%	4. Not more than 0.005% of residual manganese
	5. Sodium chlorite, not to exceed 0.5%	5. None
Oxidized starch	Chlorine, as sodium hypochlorite, not to exceed 25g of chlorine per 454 g of dry starch	None
Starch acetate	Acetic anhydride or vinyl acetate	Not more than 2.5% acetyl groups
Acetylated distarch	Adipic anhydride, not to exceed 0.12%, and acetic anhydride	- do-
adipate	Monosodium orthophosphate	Not more than 0.4% residual phosphate (as P)
Starch phosphate		None
Starch sodium octenyl succinate	1-Octenyl succinic anhydride not to exceed 3%	None
Starch aluminium octenyl succinate	1-Octenyl succinic anhydride not to exceed 2%, & aluminium sulphate not to exceed 2%	None
Distarch phosphate	1. Phosphorus oxychloride, not to exceed 0.1%	1. None
	2. Sodium trimetaphosphate	2. Not more than 0.4% residual phosphate (as P)
Phosphated distarch phosphate	Sodium tripolyphosphate and sodium trimetaphosphate	-do-
Acetylated distarch phosphate	Phosphorus oxychloride, not to exceed 0.1%, followed by either acetic anhydride, not to exceed 8%, or vinyl acetate not to exceed 7.55	Not more than 2.5% of acetyl groups
Starch sodium	Succinic anhydride, not to exceed 4%	None
Distarch propanol	Acrolein, not to exceed 0.6%	None
Distarch glycerol	Epichlorohydrin, not to exceed 0.3%	None
Hydroxypropyl distarch glycerol	Epichlorohydrin, not to exceed 0.1%	Not more than 5 ppm of residual propylene chlorohydrin
	propylene oxide, not to exceed 10%, added in combination or in any sequence	-do-
Hydroxypropyl starch	Propylene oxide not to exceed 25%	

(Adapted from *Food Starch, Modified*, Food Chemicals Codex, third edition, National Academy Press, Washington, D.C., pages 126-128, 1981.

Table 4 : Types of Modified Starches Meeting Some Formulation Needs

Marketing requirement	Chemical Modification				
	MAIZE			Tapioca	Potato
	Regular	Waxy	High, Amylose		
Gelled	4		4		
Flowable	5	2		2	2
Expanded		2		2	2
Rigid			4		
Rubbery			4		
Clarity		2		2	2
Opacity	2		2,4		
Pulpiness	1			1	
Smoothness		2		2	2
Graininess	2			2	
High temperature storage	2	2		2	2
Low-temperature storage		3,5		3,5	3,5
Low pH storage	2	2		2	2

1 : Pregelatinized and cross-linked 2 : Cross-linked 3 : Cross-linked and stabilized 4 : Thin-boiling 5 : Stabilized.

(amphoteric starch, though they are not amphoteric in the usual meaning of the word), are produced by a combination of treatments to introduce an anionic group such as phosphate, carboxyl or carboxymethyl and a cationic group such as tertiary amino alkyl or quaternary ammonium. Such starches are extensively used by the paper industry. Starches, which have been chemically modified, may be pregelatinized.

Application of Modified Starches by the Food Industry

The use of modified starches and other starch derivatives in foods and as component of articles intended for use in manufacturing, packaging, etc., is restricted by legislation in several countries. In India, though the term 'modified

starches' appears in PFA, there is no description as to which modified starches are permitted and which are not. Table 3 lists the modified starches which are permitted for use in foods in the U.S.A. Not only is the chemical treatment indicated, but the concentration which can be employed and the residuals permitted are also indicated.

Starches are generally added to foods not as a source of nutrition, but for the functional properties that they contribute. Some of the desirable traits that the incorporation of starch contributes to are texture, mouthfeel, thickening, gelling, binding, and stability. Hence, the selection of a starch in a particular application will depend on the characteristics required in the finished food product, as well as the processing conditions (Table 4).

Starches used in foods may

be derived from various sources such as maize (corn)-regular, waxy or high amylose, tapioca, potato, rice, wheat, sago, to name a few. In India, starches are produced mainly from regular maize and from tapioca. So, the modified starches available are also based on these. Small quantities of wheat starch are produced, but no modified wheat starches are produced.

In selecting a particular modified starch for a particular application, both marketing requirements and production requirements have to be considered. The market-related properties are product properties such as the structure of the product (e.g., gelled), aesthetics (e.g., clarity, smooth or pulpy or grainy), organoleptic considerations (e.g., mouthfeel, taste) and shelf stability (e.g., low pH product, low temperature storage, oil migration).

The production-related requirements are properties like viscosity, resistance to shear, low pH, high temperature, etc.

Pre-gelatinized cross-linked starches are used in many kinds of dry blends, which are mixed by the consumer with milk or water or other liquid. Instant puddings and other instant desserts belong to one such product group. To obtain the desired texture in the pudding, it is necessary to cross-link the native starch to avoid complete disruption during drum drying, which would result in an unacceptable slimy and cohesive texture in the pudding. Pre-gelatinized tuber starches, because of their blandness, are the starches of choice for such products.

Cross-linked and cross-linked, stabilized starches derived from tapioca, potato and waxy maize, either in the granular form or after pre-gelatinization, are used as thickeners in bakery custards, pie fillings, fruit fillings and cream toppings. Pre-gelatinized starches are used as components in dry cake mixes.

Acid-hydrolyzed fluidity starches are used as gelling agents in the manufacture of gum jellies such as jelly beans, gummy bears and orange slices. The starch is cooked with glucose syrup and sugar to a sol, which is deposited in starch moulds (made from low moisture starch), where setting and drying occur. The acid hydrolyzed starches can be cooked at high concentrations to give a workable viscosity, which retrogrades and set to a gel on cooling. Thin-boiling high amylose starch gels much more readily than regular starch. Often mixture of regular and high amylose thin-boils are used in confectionery manufacture. However, when using high amylose starch, it is not possible to cook the starch at

atmospheric pressure; cooking under pressure but in jet cooker is essential.

Cross-linked potato or tapioca starch, because of its low

Cross-linked and cross-linked stabilized starches are used in canned soups and other canned products.

gelatinization temperature, is used as a thickener in dry soup powders capable of reconstituting into a cream-like soup in hot water. If the soup has to be boiled after reconstitution, other cross-linked

The Indian starch industry is in a position to produce many of the modified starches, that find applications in foods.

starches can be used. Alternatively, pre-gelatinized starches can be used.

Cross-linked and cross-linked stabilized starches are used in canned soups and other canned products. Cross-linking is necessary to retain a high viscosity during sterilization. Stabilization is necessary to maintain the

rheological properties on storage.

Pre-gelatinized starches are used in ready-to-reconstitute gravy and sauce mixes. Starch esters, with a hydrophobic substituent, such as starch octenylsuccinate, can be used as emulsion stabilizers. These are available commercially as either high viscosity or low viscosity products. They are used as stabilizers for high-oil, high-viscosity systems such as salad dressings. It is possible to formulate a mayonnaise type product containing no egg, using starch octenylsuccinate. These starches have also been used to produce beverage emulsions, flavours, clouding agents etc.

Conclusion

With the growth of the processed food industry in India, the demand for modified starches should increase. The Indian starch industry is in a position to produce many of the modified starches, that find applications in foods. It is necessary to develop starches that are better suited to the Indian situation. At least one of the Indian starch manufacturers has introduced modified starches tailored for use by the confectionery and other industries. With the expertise available with the Indian starch industry and considering the fact that three of the international majors have their presence in India, via technical and/or financial collaborations, the availability of speciality food starches is assured.

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Concepts of HACCP and Traditional Food Industry - A Case Study of Khoa

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Abstract

A study was undertaken to apply HACCP concept in Khoa manufacturing in two districts of Andhra Pradesh. The types of preparation of khoa in both the areas were studied and Critical Control Points identified. The types of operation of khoa manufacture in Range Reddy district had more number of critical control points than for the type of manufacturing of khoa in Medak district. The identified critical control points were (i) handling by many food handlers ; (ii) longer duration of storage and (iii) use of soil of cleaning utensils. Installation of cold storage at the village level and improving the packaging system besides imparting education to food handlers on the microbiological and hygiene aspects of khoa would improve food safety.

The Hazard Analysis Critical Control Point (HACCP) concept is a systematic approach to the identification, assessment and control of microbial hazards in foods (WHO 1992). It has been successfully applied in developed countries to minimize foodborne health hazards (WHO 1995). Even in developing countries, HACCP approach is being attempted to apply in foodborne health hazards (Chakravarty *et al.* 1995 ; Tilak and Bhalwar 1993 ; Teufal *et al.* 1992).

Khoa, a traditional Indian milk product used in sweets like

Burfi, Peda, Gulab jamun, Kalakhand and Kheer, is prepared by partial desiccation of milk. About 7% of the milk produced in India is converted to Khoa (Ranganadhan and Rajorhia 1993). Khoa is rich in nutrients and has a water activity of 0.96, which is most suitable for growth of bacterial and moulds (Sawhney *et al.* 1994). Surveys carried out in different parts of India indicated that khoa is contaminated

borne diseases occur every year (Rao *et al.* 1989). Khoa is one of the food items implicated in these outbreaks. Foodborne diseases due to consumption of khoa-based sweets have also been reported from Maharashtra by Public Health Laboratory, Pune (Anon 1985).

A case study of khoa has been undertaken in villages around Hyderabad to see the feasibility of applying the concept of HACCP.

Materials and Methods

For the purpose of knowing the extent of foodborne diseases due to khoa-based products, the records of Institute of Tropical Diseases, Hyderabad, which were recorded separately as 'food poisoning' were scrutinized.

The HACCP evaluation of khoa preparation, storage, transport and marketing was undertaken to identify the critical control point. The households in villages in two major khoa producing districts of Andhra Pradesh viz., Ranga Reddy and Medak districts, where khoa was being prepared, were visited. Information on source of milk, storage and marketing was elicited through pre-tested questionnaire. The process of khoa manufacturing was observed.

The major marketing place for khoa produced in the above

The Hazard Analysis Critical Control Point (HACCP) concept is a systematic approach to the identification, assessment and control of microbial hazards in foods.

with foodborne disease causing organisms like *Staphylococcus aureus* and *Bacillus cereus* (Gill *et al.* 1994); Mandokhot and Garg 1985). A study carried out in Hyderabad on recorded cases of foodborne diseases had indicated that on an average, 75-100 outbreaks of food-

districts is Bela, in Hyderabad was visited. The records of *khoa* Merchants Association were scanned for day-to-day variation in price for a period of 30 days.

Results

Recorded cases of foodborne diseases : The study of recorded cases of foodborne diseases at the Institute of Tropical Medicine at Hyderabad indicated that over a period of five years i.e. 1984- 1989, a total of 24 out of 618 outbreaks due to consumption of *khoa* -based sweets have been reported (Table 1). About 225 persons were affected by these outbreaks. It has been observed that *kheer* (a milk-based sweet) was implicated in all

falo milk/cow milk. Depending upon the availability, they also add goat/sheep milk to buffalo/cow milk for making *khoa*.

The source of the milk is essentially from their own animals. The *khoa* in these areas is prepared in open pans with firewood as a source of fuel, within the household by the family members. The *khoa* obtained is slightly yellowish to brown in colour with smooth texture. It is stored in aluminium vessels without any cover and this process is repeated for 2-3 consecutive days and stored in the same vessel. On the fourth day, stored *khoa* is admixed with freshly prepared *khoa* in the hot pan itself. It is cooled to room

villages is medium scale operation running throughout the year carried out by 2-3 bulk producers per village. Each manufacturer is producing 20-30 kg *khoa*/day. The milk used is purchased from dairy farmers and is essentially buffalo milk occasionally mixed with cow milk.

The bulk manufacturer employs labour to prepare *khoa* in open pan on 3 to 4 chullas, with firewood as a source of fuel. The milk procured and stored overnight is mixed with the fresh milk before preparation of *khoa*. This practice results in splitting of milk on heating and the resultant *khoa* is granular in texture, and white in colour. It is stored in open

Table 1. Foodborne Diseases Occurred and Persons Affected in Hyderabad during 1984-1989

Year	Total no of incidents	Total no of persons	Incidents involving <i>khoa</i> -based sweets	Total no. of persons involved after consuming <i>Khoa</i> -based sweets	Type of sweet preparation involved
1985	94	688	7	56	<i>Kheer, kalakhand, kaddu ka kheer, kulfi</i>
1986	120	907	1	42	<i>Kheer</i>
1987	125	706	8	84	<i>Kheer, peda, kalakhand, kulfi</i>
1988	175	1051	3	14	<i>Kheer, kulfi</i>
1989	104	581	5	29	<i>Gulab jamun, kheer</i>
Total	618	3933	24	225	

the 24 outbreaks, *Khoa* being an essential ingredient of *kheer*.

The manufacture of khoa: The manufacture of *khoa* in and around Hyderabad is restricted to a cluster of villages in two areas viz., Ranga Reddy district and Medak district.

Ranga Reddy district : The *khoa* preparation is a small scale operation carried out throughout the year, involving 300-400 families in 30-40 villages, each contributing 1-3 kg *khoa* per day. The dairy farmers prepare *khoa* by using buf-

temperature and then packed in polythene bags and transported to city. Transportation is generally by a single person for a group of 3 to 5 farmers. In such cases, the *khoa* is pooled again and packed for transportation. Transportation time usually varies from 1-2 hours. *Khoa* once brought to market is sold on the same day, irrespective of prevailing price. The flow diagram of preparation of *khoa* in this area is depicted in Fig 1.

Medak district : *Khoa* preparation in this area covering about 30

aluminium vessels, stored overnight and transported to city next morning in polythene bags. The transportation time varies from 4-5 hours and *khoa* is sold on the same day. The flow diagram for the preparation of *khoa* in this district is illustrated in Fig 2.

Marketing : There are about 30 *khoa* commission agents in Bela in Hyderabad, who sell *khoa* to bulk and individual consumers. The *khoa* is placed on tiled floor or mat for display and exposed to flies. The trading is carried out

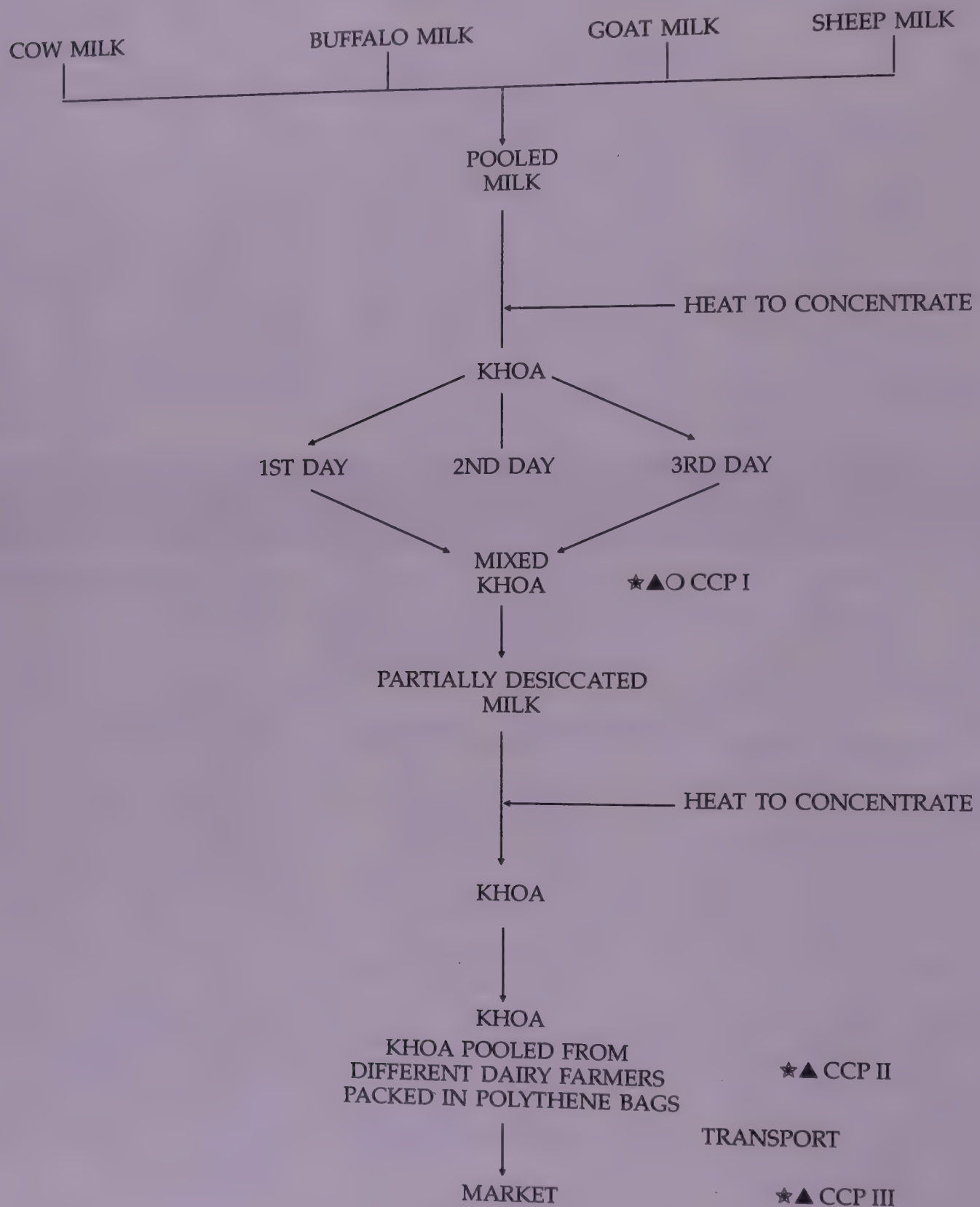


Fig 1. Flow diagram for the preparation of Khoa from individual household in Ranga Reddy district

- ★ Microbial Contamination
- ▲ Microbial Growth
- Toxin Production

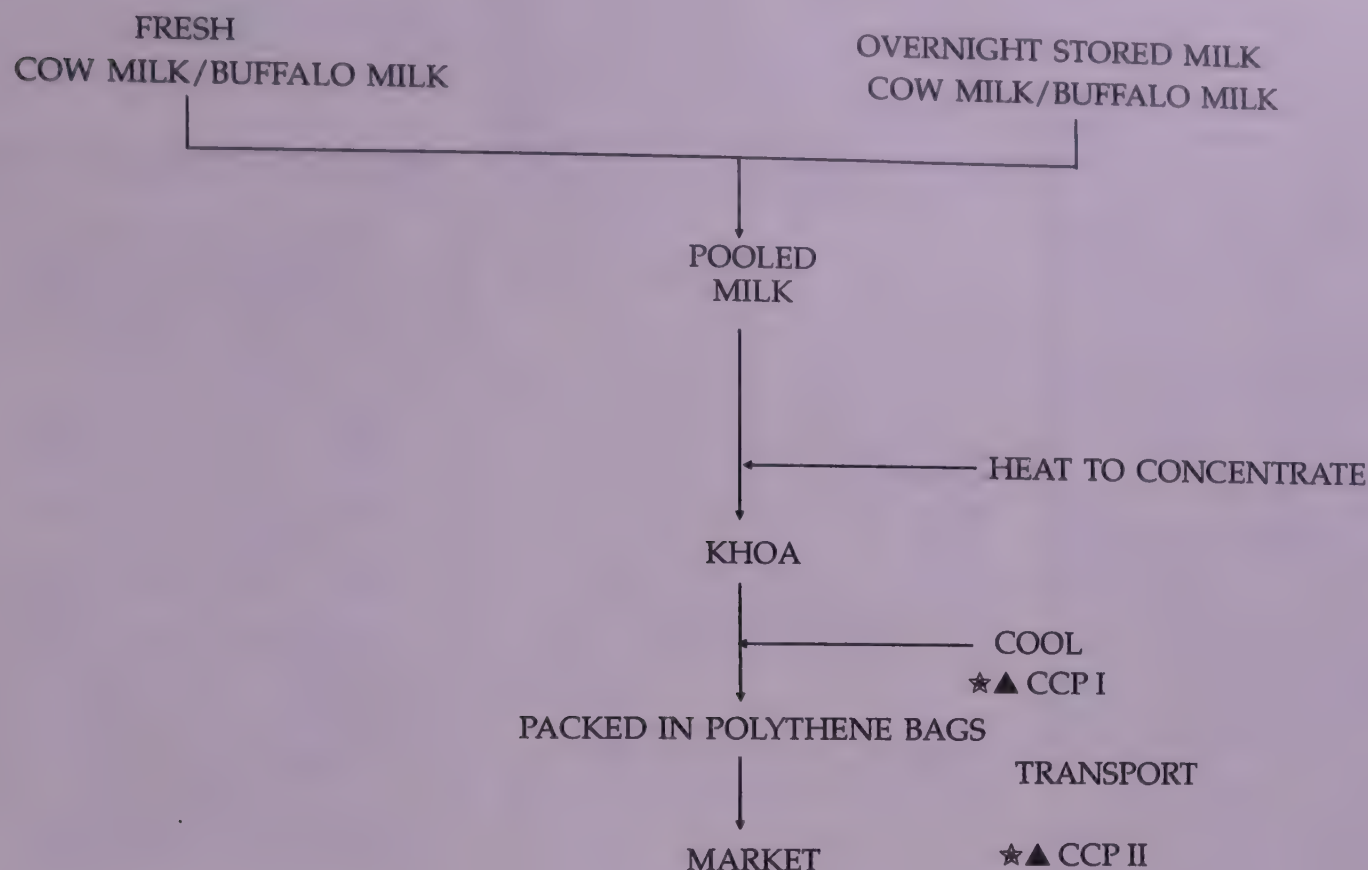


Fig 2. Flow diagram for the preparation of Khoa in Medak district

★ Microbial Contamination
▲ Microbial Growth

every day throughout the year from 8.00 am to 1.00 pm. The price is determined, depending upon the demand and supply and varied from Rs. 24/kg to Rs. 70/kg in a 30 day period. A 30 day price variation is shown in Fig 3. The quantity traded per day during festival is about 100 quintals, while it varies from 20-30 quintals on others days.

Discussion

Foodborne diseases are major health hazard in both developed and developing countries. It is estimated that the ratio of actual to reported cases of foodborne diseases in developed and developing countries varies between 25:1 and 100:1 respectively (WHO 1984). Among the foodborne diseases, *khoa*-based sweets have been implicated in several

outbreaks (Naidu 1984; Mandokhot and Chandramani 1983). The present study where a scrutiny of five year records had indicated

It is estimated that the ratio of actual to reported cases of foodborne diseases in developed and developing countries varies between 25:1 and 100:1 respectively.

that 24 outbreaks involving 225 persons were due to consumption

of *khoa*-based sweets. In contrast, in another study (Naidu 1984) in Hyderabad itself, in a short period of 6 months about 7 outbreaks involving 548 persons were reported. In all these outbreaks, *kheer* in various forms and *double ka meeta* also a *khoa*-based sweet have been implicated. In these *khoa*-based sweets, the *khoa* is added at much later stage of preparation of the sweet after which it is not held hot, instead served cold. Such sweets were prepared only during family functions but not commercially sold through sweetmeat shops. Although *khoa*-based sweets like *Gulab jamun*, *burfi* and *peda* are prepared in large scale commercially, there are very few reports of foodborne diseases involving these sweets (Mandokhot and Garg 1985).

Due to high risk nature of

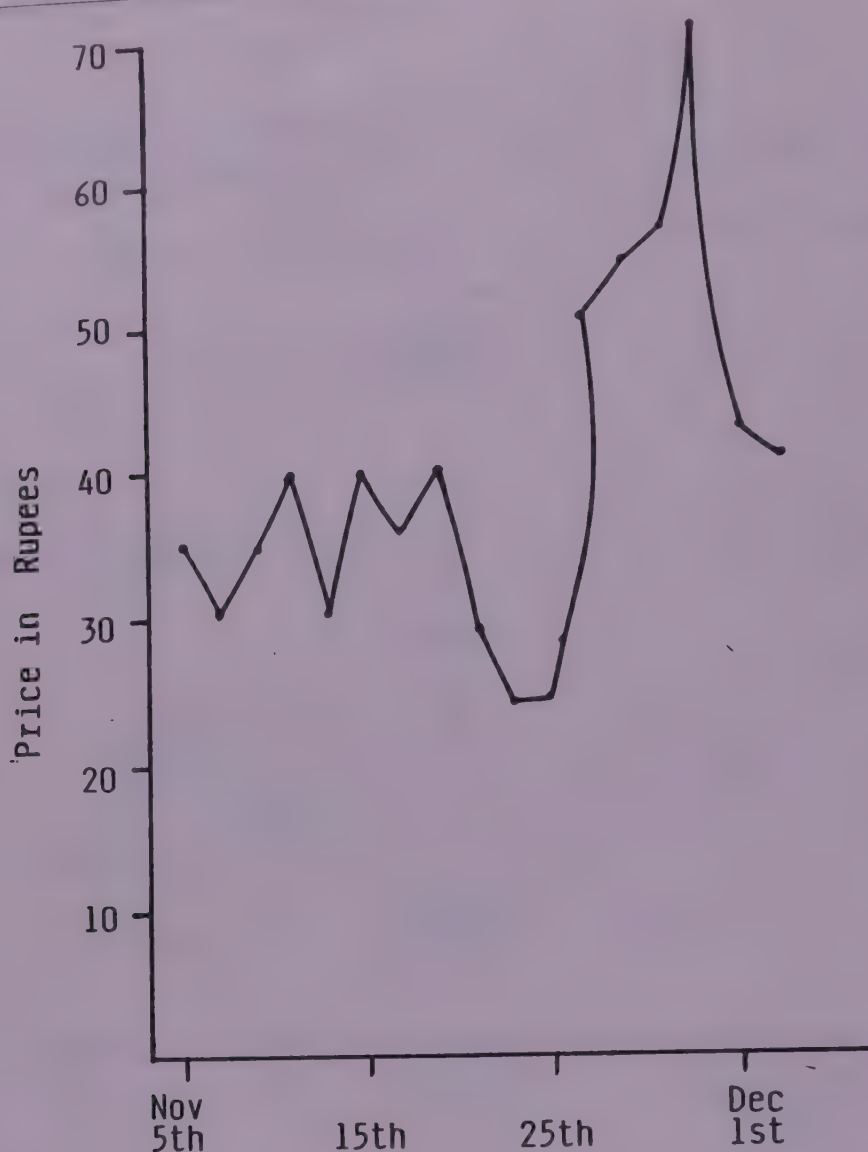


Fig 3. Variation in price per kg of Khoa in 30 consecutive days

khoa through *khoa*-based sweets, HACCP approach has been attempted. The present study indicates that there are two types of *khoa* preparation within Andhra Pradesh. It has been observed that critical control points in controlling microbial hazards in these two methods are different. Earlier studies carried out in market samples of *khoa* and *khoa*-based sweets had indicated that *Staphylococcus aureus* and *Bacillus cereus* are the two major pathogenic organisms present in *khoa* (Garg and Mandokhot 1984). *Staphylococcus aureus* contamination is due to food handlers, while *Bacillus cereus* is due to improper washing of vessels (Garg and Mandokhot 1984). Both these or-

ganisms produce toxins and ingestion of which causes the foodborne diseases (Jay 1986). Thus, the critical control points for *khoa* preparation would be, where the contamination by food handlers and the vessels used for storage take place. The proliferation and toxin production depend up on the time and temperature. A study conducted by Ghodeker and Dudani (1982) has shown that at 37°C maximum, multiplication of *Staphylococcus aureus* was taken within 48 hours and it persisted up to 7 days and then declined in *khoa*.

The critical control points in Ranga Reddy district were found to be storage of *khoa* at room temperature for 3 days, contamination due to food handlers and ves-

sels at storage, mixing of different household *khoa* before transportation, which may increase cross contamination. Finally, in the market, it is exposed to flies and food handlers, which may add to the contamination.

In Medak district, it was found that during the preparation of *khoa*, the possibility of contamination through food handlers and vessels is still there, but the time of storage before sale is considerably reduced compared to that in Ranga Reddy district. The critical control points may again be the mixing of *khoa* of food handlers and contamination through vessels, while sufficient time is not available for organisms to grow and produce toxin compared to

khoa from Reddy district.

The study has indicated that a traditional food item like khoa can be prepared by different

Providing cold storage facilities at village level to store khoa after preparation and educating the dairy farmers regarding the possible contamination due to handling khoa too many times would help reduce the microbial hazards from khoa-based sweets.

methods in different regions. The critical control points identified in two methods need different types of solutions in controlling microbial hazards. Based on the critical control points identified in the study, it can be recommended

that providing cold storage facilities at village level to store khoa after preparation and educating the dairy farmers regarding the possible contamination due to handling khoa too many times would help reduce the microbial hazards from khoa-based sweets.

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NEW MACHINERY

Multiweigh-Sort Scale for Food Packaging

Scales and Equipment Centre has developed a low-cost multiweigh scale that selects the best combination of food such as poultry, meat and fish to meet a set minimum weight. The Multiweigh-Sort scale helps fixed-weight packaging, minimising waste. It does this with up to 256 calculations from ten different weighing pans. As the calculation is virtually instantaneous, the throughput depends only on the loading/unloading speed of the operator and still higher output can be achieved with one person loading and another unloading. If a pack is to contain, for example, six items with a minimum total weight of 1000 g, four items are placed on each of the two larger "sample" pans and a single item on each of the remaining eight pans. The scale selects one of the larger sample pans and two other pans to give the least-waste six-item combination. Lamps by the pans indicate this best combination. In addition, three indicator lamps (Hi, Pass, Lo) show the achieved status. A statistical printer interface can be fitted to provide information such as date, time and weight. The amount of "tolerance" of the scale can also be adjusted for different foods such that an expensive item will have a tighter weight-control than a less-expensive food.

For more details write to :
Scales and Equipment Centre
51, Lambeg Road, Lambeg,
Lisburn, County Antrim,
Northern Ireland BT27 4QA

Pharmaceutical and Chemical Processing Machines

Shailesh Industries manufactures pharmaceutical, chemical processing and packaging machines for liquid, tablet, capsule and ointment departments. Its manufacturing range of machines includes multi mill, sifter, granulator, liquid filling, conveyor belt, turn table, tablet defoiler, deblist, ointment recovery, vial orientation, ampoule arranging, stirrer and batch printing.

For more details write to :

Shailesh Industries
Barve Memorial Complex,
1170/19, Jangli Maharaj Road,
Shivajinagar, Pune - 411 005,
Maharashtra

Liquid-Liquid Centrifugal Separator

Rupen Engineers Pvt. Ltd. offers liquid-liquid separators for various chemical operations like separation, extraction and washing, decanting, neutralisation, manufactured by CINC of USA. This patented technology, originally developed by the US Department of Energy, include such features as ability to accommodate continuous changes in input ratios (from 5% to 95%); automatic handling of variable flow rates and flow interruptions and input temperatures from near freezing to near boiling. In addition to centrifugal separation, these units also

provide the means for introducing and mixing additives for extraction, reaction, washing and emulsion-breaking. Applications are in chemical and pharmaceutical processing, oil production, oil spill clean-up, liquid waste recycling, metals extractions, etc. The separator is available in capacities from 2 GPM to 400 GPM and in various materials of construction like stainless steel, aluminium, Hastelloy, etc.

For more details write to :

Rupen Engineers Pvt. Ltd.
206, Palak Complex,
Near C.U. Shah College,
Ahmedabad - 380 014, Gujarat

Water in Oil Analyser

Kytola of Finland offers on-line monitoring of water content in oils using simple infrared spectrometric principle. The Oilan system water in oil analysis is suitable for accurate measurement of especially low water content 0-1,000 ppm (0-0.1%), with an accuracy down to 10 ppm. The microprocessor controlled system allows varied channel and analogue connection options. Since the system is on line, there is very little human interference, as sampling analysis and output are done automatically.

For more details write to :

Shaan Lube Equipment Pvt. Ltd.
A 102, Kailash Tower, Behind
STC Colony
Western Express Highway,
Andheri (East), Mumbai - 400 059

Ultra Low Freezer

So-Low, of USA, manufactures freezers in upright (vertical) and horizontal (chest) versions. Capacities for upright models range from 370 to 843 litres and those for horizontal (chest) from 83 to 766 litres. The lowest temperature attainable is -85°C . The freezers incorporate a cascade refrigeration system, digital temperature display and control, alarm system and accessories such as carbon dioxide / liquid nitrogen backup system, chart recorder, etc. Users include laboratories, universities, research organisations, hospitals, etc.

For more details write to :

Pushkaraj Enterprises

Suvidha Chambers, 1414, 1B
Sadashiv Peth,

Pune Vidyarthi Griha Road,
Pune - 411 030, Maharashtra

Quick-Clean Hygienic Pump

Roto's FNAA series pumps are designed for industries, where hygiene is of prime importance like dairy, food processing, brewery and distillery, edible oil, pharmaceuticals, cosmetics and toiletries. These pumps are simple in construction, which allow quick cleaning-in-place (CIP) after every batch. All metallic parts of the pump in contact with the medium are fabricated in stainless steel and the aseptic stator is a metal bonded elastomer resistant to oils and fats. White stators are also available for dairy and similar applications. Bearings are isolated from the pump housing to avoid grease contamination. Special care has been taken, while designing the inner contours of the pump housing to eliminate product retaining pockets. The FNAA pumps operate at

temperatures upto 130 degrees handling fluids like milk and dairy products, fruit pulp and juices, jam, medical formulations, lotions, creams, latex and many more fluids. The pump conforms to international sanitary standards and Roto offers choice of materials to suit various duty requirements.

For more details write to :

Roto Pumps Limited

308, Osian Building, 12 Nehru
Place, New Delhi - 110 019

Fixed Volume Micro Pipette

Kasablanka Corpn. offers this fixed volume micro pipette. Made of superior quality, chemically inert plastic, this high technology product is extremely precise and effectively dispenses the solution up to the last microlitre. Reverse pipetting too is completely eliminated. Being ergonomically designed and lightweight, it is easier for handling. The smooth movement of the piston makes operation very comfortable. Over a quarter century of experience has guided in designing the fixed volume micropipette. It is available in capacities ranging from $5\text{ }\mu\text{l}$ to $1,000\text{ }\mu\text{l}$ with one-year guarantee.

For more details write to :

Kasablanka Corporation

217, Princess Street, 2nd Floor,
Anant Building,
Mumbai - 400 002

Analytical Instruments and Systems

Orion Research USA, offers pH meters, ion meters, dissolved oxygen and conductivity meters, potentiometric titrators, Karl Fisher titrators, various types

of balances and on-line water chemical analysers. These analysers are used in power, petrochemical, pharmaceutical, chemical, fertiliser and process industries, including technological institutes, R&D centres, etc.

For more details write to :

Orion Research Inc.

3rd Floor, Room No. 302, 9/2,
East Patel Nagar
New Delhi - 110 008

Powder Filling System

For-Bro Engineers offers the Rapid Pack powder filling system, which is ideal for filling free flowing as well as non-free flowing products. The filling module of the system can either be auger filler or volumetric filler, depending upon the product. For free flowing, dry, crystalline powders, volumetric cup filler is ideal. Whereas, for non-free flowing and fluffy powders, auger filler is most suitable. The feeder module is consisting of a storage silo and a screw conveyor. The screw conveyor, on receipt of signal from the filling machine, feeds the product from the storage silo to the machine hopper up to a required level. The feeder module may be an overhead unit or a ground level silo with inclined screw conveyor. The silo and screw conveyor can also be designed as per one's specifications.

For more details write to :

For-Bro Engineers

10, Ashok Industrial Estate,
Plot No. 6, Udyog Nagar,
Goregaon (West),
Mumbai - 400 062

Volumetric Filler

For-Bro Engineers offers the Rapid Pack duplex volumetric filler, the Model DV-3, which is developed for filling dry granular powders into pre-formed pouches / containers. The machine can handle a wide range of products and packsizes. Packsizes from 10 g to 1 kg can be handled by the machine, by suitable change parts. The machine can give up to 40 discharges per minute, depending upon product and packsizes. The machine has two infeed discharge ports, each giving up to 20 discharge per minute. The machine discharges the set quantity of powder into the pouch/container held under the discharge spouts. All parts coming in direct contact of the product are made from SS 304. The company also manufactures machines for filling non-free flowing powders and paste.

For more details write to :

For-Bro Engineers

10, Ashok Industrial Estate

Plot No. 6, Udyog Nagar,
Goregaon (West)

Mumbai - 400 062

tamination; and Volume correction and calibration as per ISO standards. Titrations of volume 0.01 to 100.00 ml per trial. Programmable volume dosing pump for repetitive volumes from 0.03 to 100.00 ml. Memory storage feature can store one titration value. Dosing of 0.001 ml (1 microlitre) per step enhances the precision and reproducibility. Application areas include water and waste water analysis, pharmaceutical and chemical analysis, cement industries, research laboratories, engineering industries, liquor industry, etc. It is a universal titrator to replace all manual titration with high accuracy. Different titrations that have been successfully carried out on this equipment are pH/mV titrations, non-aqueous titrations, antibiotics, specific ion titrations (e.g., chloride), iodometry, sulphadiazine, enzyme activity estimations, metal estimation by EDTA titrations, redox titrations, moisture estimation (KF), reducible sugars, acidity and moisture estimation.

For more details write to :

Mayura Analytical Pvt. Ltd.

455, 18th Main, IV T-Block,

Jayanagar,

Bangalore - 560 041, Karnataka

removable baffles. Appropriate heating/cooling device will be selected from amongst baffled jackets or internal/limpet coils as per application. Complete skid mounted piping assembly is provided for operating the fermenter. The programmable controller (PLC) based process control instrumentation supplied consists of measurement and control loops for temperature, air flow, back pressure, agitator speed, pH, dissolved oxygen, exhaust gases and foam. Field instruments required are selected on the basis of accuracy of response to input/output signal, reliability, durability and capability of withstanding harsh industrial environments. A PC-based SCADA software custom-designed for fermentation processes forms part of the package. Services provided include system design as per application, installation and commissioning of the system at the user's site. Three sterility runs are undertaken for the purpose of establishing sterility of the system as well as for training of the operating personnel. Fermentation systems are suitable for a wide variety of applications such as antibiotics, vitamins, vaccines, animal cell cultures and steroids.

For more details write to :

Navin Process Systems

25/148, Pradhikaran, Nigdi,

Pune - 411 044, Maharashtra

Automatic Titrator

Mayura Analytical (P) Ltd. has developed a universal automatic titration equipment, which can carry out any type of titrations including Potentiometric and KF (Amperometric) titrations in a single unit. This instrument stops automatically at the end point of titration and requires no indicator. Features include : Automatic suction from reservoir and dosing to titration vessel; Automatic dosing to titration vessel; Switch board control of suction, delivery and rinsing; Easy and fast interchangeable burettes avoid cross con-

Fermentation Systems

Navin Process Systems offers a complete integrated pilot plant and medium size commercial fermentation systems on a turnkey basis. The range of sizes covered is from 20 litres to 20,000 litres. Material of construction used is stainless steel (grade 304/304L/316/316L or as per application). The fermenters consist of a top driven agitation system with geared AC motor, variable speed drive, single dry running mechanical seal, flat/inclined/curved blade turbine impellers, bottom bush support and

Continuous Vortex Screw Mixer

The **Engelsmann** vortex screw mixer allows conveying, mixing and emptying in one continuous process. This mixer consists of a U-shaped trough and the one-shaft or two-shaft rotor system rotating in the trough. In the case of double-shaft mixers, counter-acting shafts with blades serve as mixing tools, with the blades

having different inclinations. In the case of the double rotor system used more frequently, the product to be mixed is taken by the external edges and thrown upward in the centre above the mixer shafts. In this way, a weightless area, that is to say a mechanical fluidised bed is produced. This, however, is only possible by exactly adjusting the peripheral speed to the product. The main features of this type of mixer are rapid and gentle mixing as well as high mixing capacities with minimum wear in the mixer. Applications are in the chemical, pharmaceutical, plastic processing, food industries for a wide range of products such as powders, granular or spherical products, fibres and flakes. It is even possible to feed liquid products. The mixer is available in dust-tight, gas-tight or pressure-tight execution and made of all construction materials in demand. If necessary, it can also be provided with heating or cooling.

For more details write to :

Industrial & Commercial Enterprises

77, Mahim View, 2nd Floor

Soonawala Agairy Marg, Off Mori Road

Mahim (West), Mumbai - 400 016

Indicating Temperature Controller

MB Control offers the Model DT-293 digital indicating temperature controller with audio-visual alarm. The controller has two independent front-panel potentiometer set points for control and alarm. An audio-visual alarm is given, when the alarm set point is exceeded. The DT-293 accepts as inputs all types of temperature sensors and linear signals. The instrument accuracy is within $\pm 0.5\%$ to $\pm 1\% \pm$ LS digit. Power supply is 220 V / 110V AC.

Other features include automatic cold-junction and line-resistance compensations, built-in sensor break indication and protection. Relay output, 1 CO, 5 A, 230 V AC non-inductive is provided for temperature control. Dynamic burn-in tested, the instruments are housed in size 96 x 96 x 160 mm DIN standard strong metal enclosure. The instruments are particularly suitable for industrial applications such as in furnaces and ovens, steel, paper, cement, fertiliser, beverages, chemicals and for processing plants and oil refineries.

For more details write to :

M. B. Control & Systems Pvt. Ltd.

31/1, Ahiripukur Road, Calcutta - 700 019

Solvent Recycling

Ateliers Sussmeyer of Belgium has developed a solvent recovery unit, the SRP, which can recover 95-99 per cent of the solvent from a polluted product. The unit, based on the vacuum process, is simple to use and reliable. The SRP process incorporates the advantages of the steam stripping process without the problem of water inclusion in the clean solvent. The actual solvent vapours are used as calorific media and the high flow and speed of the vapours in contact with the surface of the dirty solvent cause it to be agitated. The SRP has specific technical characteristics. It is a vacuum process. There is no heat transmission surface in the dirty solvent part and no mechanical agitation. The output remains constant throughout the recycling process and the sludge is compact. The vessel is easy to empty, the whole process is virtually maintenance-free and only an unskilled worker is required. The SRP can recycle 60-960 litres of solvent per hour depending on the size of the

unit. It comes fully automated or with a fractionating process.

For more details write to :

Ateliers Sussmeyer SA

Rue de Birmingham 222, B-1070 Brussels, Belgium

PVC Pipes

Uniplas India Ltd. manufactures PVC pipes as per IS 4985 specification ranging from 20 mm to 315 mm. Features of these pipes are : lightweight, durable and non-corroding. These pipes are resistant to chemicals like acids, alcohols, alkalis and halogens and have improved flow than that of metallic pipes.

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K. P. Marketing Agency

3rd Floor, Stonedge Towers, 17, 1st Avenue, Ashok Nagar,

Chennai - 600 083

Pesticide Spraying Coverage Analysis System

A computerised vision system for analysis and control of pesticide spraying coverage has been developed in Israel. The video image processing, a DSP-based system, captures the image of the droplets spread on the target and analyses the droplets size distribution and the coverage efficiency related to the Effective Radial Distance from the droplet (ERD). The system consists of CCD camera with magnification lenses, a dedicated illumination source and a high performance video image processing system for processing and analysing the dyed droplets.

For more details write to :

Senior Trade Representative

Consulate-General of Israel
Kailas, 50-G Deshmukh Marg,
Mumbai 400 026

Filter Aids

African Diatomite Industries Ltd. is one of Africa's major producers of diatomite under the trade name Kensil. These filter aids are mainly used by various industries like beer, sugar syrup, dry cleaning solvents, fruit juices, lubricating/vegetable oils, pharmaceuticals and other viscous liquids. They are mainly used where a high degree of clarity is required.

For more details write to :

Dossa Harjee Pvt. Ltd.

257/59, Yusuf Meherali Road,
Mumbai - 400 003

Freeze Dryer

Pharmalab offers AMSCO / FINN - AQUA LYOVAC range of freeze dryers. This compact system is ideally suitable for lyophilising natural products, peptides, proteins, solvent-based products, etc. These freeze dryers are built on modular concepts and are of two-chamber designed with microprocessor controls. This design offers GLP and enables to carry out PRM to determine the end of drying cycles and BTM for getting precise temperature for the product. The microprocess is provided with an interface for data recording and offers precise control on Lyophilisation process. The R&D freeze dryers are available in 14 different models for lyophilising products in vials/ampoules/bulk/bulbs or combination. The refrigerant used is environmental friendly.

For more details write to :

Pharmalab Engineering India Ltd.
Star Metal Compound, LSS Marg
Vikhroll (West), Mumbai - 400 083

Spray Nozzles and Accessories for Dairy and Food Production

Maco offers spray nozzles for automatic rinsing and washing of any vessel, spray gums and nozzles for cleaning equipment, nozzles for efficient clean-in-place systems for bottling machines, nozzles for quick automatic cleaning of bottles and cartons, and nozzles and accessories, from Spraying Systems Corporation, USA, for many other applications in the dairy, beverage and food industries.

For more details write to :

Maco Corporation (India)

"Todi Chambers", 5th Floor, 2,
Lal Bazaar Street,
Calcutta - 700 001

Vibratory Separator

Rachana manufactures the Vibro-Separo vibrating separator (sifter), used for separation, classification and filtering of powders, grains, slurries, liquids, etc. The separator gives higher output, consumes less power and requires minimum maintenance. A maximum of five separations are possible simultaneously in one separator. The outlet position can be set at site at any angle (0 to 360 degrees), and the flow pattern can be easily varied depending on the application and the material being screened. Available in five standard models, the machine is specially suited to industries such as pharmaceuticals, paint, ceramic, food, paper, brewery, chemical and plastics. Applications cover screening of abrasives, chemicals, coffee, detergents, fertilisers, flour,

oil, paint, tea, tobacco, milk powder, starch, etc.

For more details write to :

Rachana Engineers

35, Kanyakumari Shopping
Centre, Sir N. V. Road

Andheri (East), Mumbai - 400 069

Horizontal Vacuum Belt Filter

Adpec Filters (India) Pvt. Ltd. manufactures horizontal vacuum belt filters. Some of the distinct features of these filters are : Completely pneumatically operated and safe to operate in any hazardous atmosphere; Modular construction and no restriction on size of width & length; Useful in a wide range of filtration / dewatering applications; For wetted parts, any combination of materials of construction is possible such as PP/SS/MS/MSEPOXY/FRP; Prevents spillage, absolutely no drag and does not need rotating pulley for friction drive of filter cloth; No rubber carrier belt; Very effective cake washing systems; Filter cloth in motion only when vacuum is off; cloth changing very simple in minutes. Applications are in agrochemicals, aluminium chloride, calcium carbonate, calcium hydroxide, catalysts, cement, citric acid, dicalcium phosphate, effluent sludges F at (oleine) extraction, fermentation broth, fine chemicals, foundry sand, gypsum, iron stearate lead oxide, metal powder, methyl methacrylate molecular sieve, PTFE, pectin, pesticide, pigments, plastic additive, polymers, salt, silica, sodium fluoride, vitamins, zeolite and zirconium oxide.

For more details write to :

Adpec Filters (India) Pvt. Ltd.

18, Gr. Floor, 240, JB Road,
Mangal Wadi

Girgaum, Mumbai - 400 004

NEW PRODUCTS

A New Coffee Brand from Hindustan Lever

Hindustan Lever Limited (HLL), the market leader with its Bru instant coffee, in a bid to woo coffee drinkers has recently developed a new technology that helps retain the same aroma and flavour in branded coffee, as in freshly ground powder. The technology has been used in the company's Deluxe Green Label Roast & Ground (Filter) coffee brand. The new gas-flushed (as the technology is called) coffee has already been launched in the southern States of Karnataka, Andhra Pradesh and Tamil Nadu.

The new coffee has been extensively tested among consumers in Chennai and Hyderabad. The results have shown that the coffee is significantly better than other brands in the category in terms of aroma, flavour and freshness of powder, which are the main attributes sought by coffee drinkers.

The Roast & Ground (filter) coffee market is divided into two segments-premium priced over Rs 120 a kilo and popular. HLL claims the Deluxe Green Label has a market share of 62 per cent in the premium segment and in the overall category has about 39.8 per cent. It hopes that the shares will go up with the introduction of the new technology.

Currently, in the total coffee market, HLL has a share of 30.4 per cent by value, Nestle has a 24.6 per cent share and Consolidated Coffee has about 3 per cent of the market.

HLL's new product launch comes at a time when the domestic instant coffee market has shrunk by over 30 per cent since 1994.

The market share for Bru (a leader in the chicory-mix instant coffee segment) had plunged from the 52 per cent dominance in 1991-92 to 38 per cent. HLL plans to offer a basket full of products at the breakfast table, unlike its competitors which can offer two on three products.

Kellogg's Chief Launches three New Brands

Mr Arnold G Langbo, Chairman and Chief Executive officer (CEO) of the \$7 billion Kellogg Company made a one-day trip to India to unveil Kellogg India's nutrition initiative in the country centered around 'Iron shakti.'

He launched the three new staple brands with added fortification of iron and Vitamin C-Kellogg's corn flakes, wheat flakes and basmati rice flakes before visiting a local school to launch Kellogg's school nutrition programme.

Iron deficiency, affects nearly a billion people worldwide and is especially prevalent among kids and women of child bearing age in developing countries. In India, it is estimated that six out of ten children and eight of ten pregnant women are anaemic.

The iron requirement per person in India is estimated at 28 milligrams every day on an average. Towards this, Kellogg India is launching iron fortified cereals and grain products.

Household Point of Use Water Filter

The 'UltraPura' line of point-of-use water filter treats and purifies non-potable, contaminated water by combining granular activated carbon, a well-known method of filtration, with NF-85, an international patented medium. The use of these elements allows the filter to remove toxic contaminants and most bad tastes and odours and provide up to 40,450 litres of good-tasting water.

Instant Hot Water Dispenser

Anahein Marketing International has introduced an Instant hot water dispenser which delivers upto 609 cups per hours of steaming hot water for coffee, tea, cereals, soups, snacks etc. It is made of genuine stainless steel with an exclusive deflection device that prevents corrosion. This product is easy to install connecting to cold water supply and operate with a twist of the wrist, the Water Dispenser is on and after releasing the knob, the hot water shuts off automatically.

For the above 2 products, Contact : Edward E Chavez, Pres, Anaheim Marketing International, Dept CN, 4332 East la Palma Ave, Anaheim, California 92807 USA. Telephone : 714-993-1707. Fax : 714-993-1930. E-Mail : anabeimktg@aol.com.

RESEARCH ROUND-UP

Paan Masala Found Carcinogenic

A recent study conducted jointly by the Regional Cancer Centre, Thiruvananthapuram and the Johns Hopkins University of the US has revealed that 19 of 22 popular *paan masala* brands are carcinogenic. The study further says that important ingredients like arecanut, *gutka*, and lime are responsible for the proliferation of cancer cells. The study examined some 54,000 people in Kerala to identify *paan masala* users and correlate it with cancer rates. It was found that *masala* caused sub-mucous fibrosis, which precludes cancer. The ingredients were studied for cancer activity in both US and Indian Laboratories.

Americans Nod to Food Biotechnology

New survey results of 1,004 Americans found that people are not only aware of food biotechnology, they are excited about its benefits. Survey respondents also indicated strong support for the Food and Drug Administration's (FDA) current labelling policy for biotechnology-enhanced foods.

Eight-out-of-ten Americans were aware of biotechnology and those same 80 per cent are expected to derive benefits from biotechnology within the next five years. In addition, more than three-fourths (78%) agreed with the FDA's current labelling policy. FDA requires biotechnology-en-

hanced foods to be labelled as such only, if there is significant change in composition or nutritional content or a possible health concern.

The survey was conducted by the Wirthlin Group, in March 21-24, 1997 and presented at an International Food Information Council (IFIC) media briefing in Washington, DC on March 27.

"American consumers recognize the value of food biotechnology because they appreciate environmental benefits such as protecting crops from insect damage while reducing pesticide use," stated Sylvia Rowe, IFIC President. "They also like the potential for fresher, more healthful and better tasting fruits and vegetables made possible through biotechnology." The ability to protect crops from insect damage and reduce pesticide use was the most widely appreciated benefit. Over three-quarters of respondents (77%) said that they would be "very likely" or "somewhat likely" to buy foods, if they were enhanced through biotechnology for these environmental benefits. Dr. Thomas Hoban, Professor of sociology and consumer opinion expert from North Carolina State University provided perspective for the new survey data by comparing them with previous trends on consumer attitudes showing that : 1) The majority of American consumers have consistently supported the use of food biotechnology over the past 10 years, 2) Consumer awareness and understanding of food biotechnology varies from country to country due to various factors and 3) American consumer acceptance is attributed to consistent and proactive educational efforts.

Go Fish and Say Good-bye to Coronary Heart Disease

A study published in the April 10, 1997 issue of The New England Journal of Medicine found that eating fish may help lower the risk of death from coronary heart disease.

The 30-year study was conducted among 1,822 employees of the Western Electric Company in Chicago and found that men who eat seven ounces or more of fish a week are less likely than those who rarely eat fish to die of heart attacks. A serving of fish is about three ounces cooked, or about the size of a deck of cards.

"The good news is that eating small amounts of fish - amounts that can easily fit into all people's diets - may make a difference," said Dr. Martha L. Daviglus, Head of the study and a preventive medicine specialist at Northwestern University Medical School.

The study did not examine the type of fish eaten, but Dr. Daviglus noted that it was probably canned tuna and other fish like flounder and cod.

This research supports several previous studies that found cardiovascular benefits from eating fish. Although these results are positive and support recommendations to consume more fish, experts emphasized that more research is needed to determine the mechanisms by which eating fish protects against heart disease.

Squeezing out Bitterness from Grapefruit

Grapefruit juice without the usual sharp tang could be on sale within two years, thanks to a new industrial technique that extracts the bitter components. Sepragen, based in Hayward, California, says its system is the first large scale application of chromatography, a technique usually confined to the laboratory.

When a liquid containing a mixture of chemicals is forced through a narrow column of resin, the different chemicals flow through at different speeds. Industrial use of the technique has been limited until now because pressures of thousands of atmospheres are required to force material through the resin. The liquid also passes through the columns too slowly for use in large-scale manufacturing.

Sepragen says that it has overcome these obstacles. It uses wider tubes and the liquid flows from holes in the sides of the tubes into the centre. This is faster than conventional chromatography and requires less pressure.

With its patented 'radial-flow' chromatography, the system works at pressures of just one or two atmospheres and produces flow rates that are 500 times faster than conventional chromatography. Vinit Saxena and his colleagues at Sepragen tailored the resin so that it would capture naringenin, the bitter-tasting compound in grapefruit as the juice washes through. "It tastes remarkably different," says Saxena. "It has the body and the general flavour, without the bitter taste," he says. The company has a similar system for extracting limonene, the compound that imparts a bitter aftertaste to orange juice.

The company is also using the technology on cow's milk in an effort to produce infant milk formulas that are closer to the composition of human milk. "That's the Holy Grail of the infant formula industry," says Saxena. Cow proteins such as betalactoglobulins and bovine immunoglobulins are extracted and discarded. Other compounds such as lactoferrin and lactalbumin, which occur at low levels in cow's milk, are extracted and rebled at concentrations close to those found in human milk.

The milk rebinding technology is being tested by Carberry Milk Products, a company near Cork in Ireland that supplies milk extracts to makers of infant formula. Sepragen is also in talks with major American producers of fruit juices about using its technology.

In the long term, Sepragen is considering applying the technique in the winemaking and brewing industries. One possible application, according to Saxena, would be to extract chemicals from wine that are characteristic of an immature vintage and so hasten the rate of ageing.

Going with the Grain

Recent research conducted by the NPD Group in conjunction with a Gallup consumer survey found that the message of the Food Guide Pyramid - that grain food should be the basis of the diet - is reaching Americans.

Although grains are the only food category to record increased consumption over the past 10 years, Americans still do not get enough from the base of the Food Guide Pyramid. The Gallup survey found that Americans eat 3.2 servings of grains a day, well below the 6-11 servings recommended by the Food Guide

Pyramid. It appears that the message of the Food Guide Pyramid may be reaching Americans, but they are not putting what they know into practice.

Judi Adams, a registered dietitian and President of the Wheat Foods Council, said that consumers remained confused about the value of grains due, in part, to the recent reemergence of fad diets that position carbohydrates as fattening.

"Unfortunately, this type of nutrition confusion is steering people away from the foods they need most," said Adams.

Despite the fact that more Americans than ever report being very familiar with the Food Guide Pyramid, Americans are heavier than ever before. According to Dr. Fergus Clydesdale, member of the Food and Drug Administration's Advisory Board, "Inactivity and excess calories" are largely to blame for this situation.

Increased Consumption of Fruits and Vegetables Helps Reduce Blood Pressure

A diet rich in fruits and vegetables and low in fat produced significant reductions in blood pressure within two weeks among hypertensive patients. The findings of the study, conducted at five medical centers across the country, were presented at the recent scientific meeting of the American Heart Association.

According to Lawrence Appel, the Principal investigator for the study at Johns Hopkins University Medical Center in Baltimore, altering diet and lifestyle habits - including weight loss,

RESEARCH ROUND-UP

increased physical activity and reduced salt and alcohol intake - can replace pharmaceutical drugs in treating some cases of high blood pressure.

The study, Dietary Approaches to Stop Hypertension (DASH), measured the effect of diet on 459 adults with high blood pressure. Half of the test group were women and 60 per cent were blacks, who suffer more frequently

from high blood pressure than whites.

One-third of the test group was fed a typical American diet, low in fruits and vegetables and high in fats. A second group was given extra fruits and vegetables but was permitted to eat the same food as the first group. The third group ate a combination diet that was low in fat and saturated fat - including low-fat milk and yoghurt - and comprised 9 to 10

servings of fruits and vegetables, more than twice the amount of fruits and vegetables consumed by the average American.

The group on the combination diet of fruits, vegetables and low-fat products achieved the greatest reduction in blood pressure. Slight reductions in blood pressure were also seen within the group, whose diet was high in fruits and vegetables but the same in fat.

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TRADE FAIRS & GET-TOGETHERS

"Made in India" Exhibition at The Netherlands

As part of the celebration of 50th Anniversary of Indian Independence, a 'Made in India' exhibition will be held at Amsterdam, The Netherlands from 4th to 6th November 1997. This will be organized by various Indian Embassies in Europe. In addition, an "Indian Opportunity" seminar also will be organized.

For more details, contact :

Dr Amit Mitra

Secretary-General

FICCI

Federation House,

Transen Marg,

New Delhi - 110 001

Tel : 3738760

Fax : 91-11-3320714

Vietnam Food and Hospitality Week - 1997

Ho Chi Minh City will host Vietnam Food and Hospitality Week '97 from 5-8, November 1997. Vietnam Food and Hospitality Week '97 is Vietnam's third International trade exhibition of food products, services, equipment and food processing machinery, packaging and technology for the restaurant, hotel catering and food industries.

For more information, contact :

Export Promotion Services
Agency Co. Ltd

1205, 283/62, Sukhumvit 55
Road,

Bangkok 10110, Thailand

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vndnet

Food & Hotel '98 - Philippines

The International Hotel, catering equipment food and drinks exhibition will be held at the World Trade Centre in Manila, Philippines from 15-18 February 1998. The exhibition is organized by Philippines International Exhibition & Conventions and Overseas Exhibition Services of the Montegemery Network. It has supports from the Department of Trade and Industry ; Department of Science & Technology and Philippines Chamber of Commerce and Industry.

The exhibition is an ideal platform to explore opportunities and meet the try buyers within the food, drink and hospitality industries.

For details contact :

Elizabeth wood

Exhibition Manger

Overseas Exhibition Services Ltd

11, Manchester Square

London W1M 5AB, UK

Tel +44 (0) 1714861951

Fax +44(0) 1714138210

email : Wood @montnet. com

OR

Joanna Leong,

Asean Agents

International Expo.

Management (P) Ltd.

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Singapore 229233

Tel +65 339 2633

Fax + 65 338 6542

World Spice Congress 1998- Exhibition

As part of the World Spice Congress 1998, an exhibition is being organized to display Indian Spices and Spice products to the overseas delegates. The exhibition will be held from 23-25 January 1998 at Hotel Taj Coromandel, Chennai (Madras). The convener of the exhibition is Shri O.T.S. Nambiar.

Address :

Publicity & Exhibition Committee,

World Spice Congress - 1998

Spices Board,

Cochin - 682 025

Tel : 0484-333610/341022

Fax : 0484-331429/334429

Packaging Seminar

A Seminar on "Fiberboard Packing Techniques for Development of Protective and Cost-effective Fiberboard Packages" will be held during November 21, 1997 at San Jose State University, Professional Development Center, San Jose CA 95128-2530, USA. The Seminar covers topics from fundamentals to the most advanced issues in corrugated fiberboard packaging design, including packaging strength and factors that cause performance deterioration, cost-saving techniques, use of computers, specifications, palletization and unitization and other current issues. It is designed with a blend of theory and practice with a number of applications from different fields. Packaging engineers, designers, and technologists, distribution, warehousing and logistics personnel, sales and customer service personnel are invited to attend.

For further information, contact :

Dr Jorge Marcondes

Co-ordinator

Packaging Seminars,

San Jose State University
Professional Center,
3031, Tisch Way,
Suite 200, Plaza East,
San Jose, CA 95128-2530, USA
Tel : (408) 924-3210
Fax : (408) 924-2955

IV International Food Conference (IFCON - 98)

"Trends in Food Science and Technology - Global Perspective "

A Preamble

The biggest challenge faced by the food industry today is globalisation. The challenge of food, poverty, and malnutrition confronting the world demands concerted action to avoid lopsided development and consequent social and economic turmoil in many parts of the world.

The new intellectual property rights and patent laws will have far reaching impact on the food

industry. Global marketing has now become the most critical and expensive component of food industry. The regulatory agencies must give freedom to innovate new technologies and should not put hurdles and stunt the industrial growth.

The natural resources for food production are decreasing because of the environmentally and ecologically unfriendly manner by which land and water resources have been used, combined with continuous rise in population. The challenges posed by globalisation, IPR, patent laws, regulatory agencies, globalised marketing, environmental degradation, ecological imbalance, scientific and technological under-development and socio-economic inequalities can be met only by co-operative and complementary efforts by the scientific community the world over. Against this background, in collaboration with the Central Food Technological Research Institute, the Association of Food Scientists and Technologists (India) is organizing the IV International Convention of Food Scientists and Technologists IFCON - 98 during 20-24 November, 1998 at Mysore, India. Please watch out for the first circular for more details.

AFST(I) NEWS

Parbhani chapter

Parbhani chapter of AFST(I) organized a seminar on topic entitled "Biochemical and genetic studies on enzymes and lipid production by micro-organisms" by Dr. Richard Joseph, Deputy

Director and Head, Department of Microbiology C.F.T.R.I., Mysore on 19-7-97.

This function was presided over by Dr C.D. Mayee, Vice-Chancellor, Marathwada Agricultural University, Parbhani. Wel-

come address was delivered by Dr. U.M. Ingle, President of AFST (I) Parbhani chapter and Director of Extension Education M.A.U. Parbhani. Prof S.S. Thorat introduced the guest and compered the programmes. Prof. D.R. More proposed a vote of thanks.

DATA BANK

India's Agricultural Exports during 1995-97

Commodity	95-96	(P) Provisional	(Rs crores) 96-97 (P)
Pulses	131.8		61
Rice	4550.0		1825
Wheat	360.9		675
Cereals	17.1		40
Tobacco	365.8		254
Spices	785.9		606
Cashew	1232.1		827
Oilseeds	482.5		183
Oil meals	2350.5		1339
Sugar & molasses	503.6		739
Fruits & vegetables	676.6		379
Tea	1171.7		642
Coffee	1509.2		960
Castor oil	733.8		881
Cotton	206.1		397
Seafood	3384.2		2174
Others	1781.8		1568
Total	20243.6		13550

Source : Ministry of Commerce.

Production of Salt in India (1994-96)

State	1994	1995	in '000 tonnes 1996
Andhra Pradesh	262	140	276
Diu & Daman	16	24	33
Goa	2	2	3
Gujarat	8881	8824	10404
Himachal	2	2	3
Karnataka	22	17	19
Maharashtra	186	224	246
Orissa	51	27	47
Rajasthan	1097	1526	1131
Tamil Nadu	2011	1739	2284
West Bengal	14	19	22
Total	12544	12544	14468

Source : The Economic Times dated 17 Sept. '97.

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Research Papers

Evaluation of New Grape Hydrides for Dehydration - by I.N. Doreyappa Gowda, R. Singh and B.N.S. Murthy

Comparative Properties of Rice Flakes Prepared Using Edge Runner and Roller Flaker - by S. Ekanayaka and H.V. Narasimha

In vitro Enzymic Oxidation of Apple Phenols - by K.L. Bajaj, C.A. Diez De Bethencourt, B. Junquera and M.L. Gonzalez- San Jose

Effect of Long Term Feeding of High Fat Diets on Growth, Plasma and Tissue Lipids in Rats - by K. Narasimhamurthy, P.L. Raina and K. Hariharan

The Effect of Flour-blending on the Physico-Chemical and Sensory Qualities of Bread - by Chinyere I. Iwuoha, Alex C. Anyadike and Onyekwere S. Eke

Research Notes

Effect of Caseinates on Physico-chemical, Textural and Sensory Properties of Chicken Nuggets from Spent Hens - by R.R.B. Singh, K.H. Rao, A.S.R. Anjaneyulu,

K.V.S.S. Rao, P.C. Dubey and P.L. Yadav.

Physico-chemical Characteristics of Extruded Snacks Prepared from Rice (*Oryza sativa*, L) and Chickpea (*Cicer arietinum*, L) by Single Screw Extrusion - by S. Bhattacharyya, P. Chakraborty, D.K. Chattoraj and S. Mukherjee

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Nutritional and Cooking Evaluation of Greengram (*Vigna radiata*, L. Wilezek) Cultivars - by Anita Kochhar and Charanjeet K. Hira

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